FOUNDRY TRADE JOURNAL

Established 1902

Vol. 96 Thursday, February 18, 1954 No. 1955

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PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s. Abroad 45s. (Prepaid).

49 Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Safety by Legislation

There are two major methods of reducing accidents in industry; one is by attempting to make the entire plant foolproof and the second the inculcation into the minds of the whole staff an awareness of the ever present danger of accidents. At the moment there is a Private Member's Bill before the House centring around this subject. It is designated the "Safety in Employment (Inspection and Safety Organization) Bill," and is due to have its second reading next Wednesday. By and large, most stress is laid on the first precept enunciated above, whereas we attach greater importance to the second. Everybody knows the type of the individual, who, though quite normal in every other respect, is accident prone to the point of burlesque, so much so that he is on occasions given a nickname in the shops—"Chaos" being a typical one. This person needs psychological training, as the foolproofing of machines is of no avail in his case.

An early clause in this Bill states that it is incumbent on employers and employees in all places of employment, where not fewer than five persons are employed, to create a safety and health organization. Such an enactment would be bordering on *opéra bouffe*. If it be applied to a country solicitor's office, a circus, or the local hostelry, the ridiculous aspect of this clause is obvious. The next part says that the representative of the employees would have to make an inspection once a month and prepare a written report of his observations and recommendations to the employer. For the smallest workshops, this does not make sense, because a potential source of danger on being recognized as such seldom carries no real risk. In any case, such a condition would not be designated as dangerous by one daily living beside it, and, in truth, no hazard does exist—except to the casual visitor. The employee representative would, according to the Bill, have to be furnished with copies of all documents relating to safety and health sent to the employer by the Factory Inspector. We hope the Department concerned would in this event send their communications in duplicate even to the smallest shops, as typing and clerical facilities are often meagre in tiny establishments.

Clause 3, which deals with concerns employing more than 50 persons, requires that safety committees would have to be set up and, at his discretion, a Factory Inspector may be present at their meetings. The proposed duties and constitution of such committees are cited. Many works have operated safety committees for years, and where real enthusiasm is present they can serve a useful purpose, but compulsion has the opposite effect from that of generating enthusiasm. Every employer recognizes that the reduction of industrial accidents is both eminently desirable and entirely laudable, whilst a lowered accident rate beneficially influences production and morale, to say nothing of easing the present high costs of insurance premiums. As it stands, this Bill needs alteration before it could be universally accepted. It is incumbent on all foundry owners, especially those controlling the smaller type, to make known their views through either their local Member of Parliament or their appropriate employers' association.

Correspondence

THE CASE OF THE DISAPPEARING CHILL

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I was indeed thrilled with the account of Foundry "Brains Trust" in the January 28 issue of the JOURNAL, but was disappointed with the explanations submitted by the team to Question 2, relating to the chills which were hollow, after withdrawal from the casting. May I offer my opinion on the matter? Considering the solidification of the metal surrounding the chills, columnar crystals are quite early precipitated over their surface. This initial formation of solid iron around the chill acts as an insulator against direct solution of the chill from the surface. However, the temperature of the chill, and that of the metal surrounding it, is highest at the periphery of the base (A) (Fig. 1)—this because of its position relative to the bulk of liquid metal. I suggest it is at this confined point that re-solution of the primary columnar crystals occurs, followed by the melting of the actual surface of the chill at the corners, particularly. The remaining surface of the chill is perfectly preserved by the metal originally solidified. Thus, conditions would be as shown in the sketch, and any liquid metal in the interior of the chill would be drawn out from the position A, due to shrinkage of the mass of metal in which it is immersed. As the point A may be merely a crack following the circumference of the bottom of the chill, the latter may quite easily pass unnoticed after withdrawal of the chill.

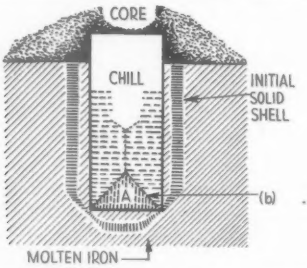


FIG. 1.—*Diagram illustrating Mr. Underwood's explanation of the disappearing chill. If the chill had itself been quickly cooled, it is conjectured that lines of cleavage would exist at the inter-dendritic spaces (b) through which molten liquid metal could be drawn from A.*

Also, considering the structure of the chill, during the original casting of the chill, solidification would commence at the surface of the chill mould. Hence the metal having the highest melting temperature would be on the outermost regions of the chill, and the fusion point would become progressively lower towards the centre of the chill. Certain compositions of iron would facilitate this condition; for example, iron high in phosphorus and sulphur, due to segregation, would exaggerate this tendency. Such a structure would be very prone to the phenomena related by Mr. Hammond in connection with pig-iron fusing from the centre outwards during cupola melting.

Briefly, the chill melts from the inside outwards, due to the reasons stated, and the molten interior is drawn out through the only portion of the surface which has been fused, *i.e.*, the periphery of the base.—Yours, etc.,

JOHN UNDERWOOD.

Bell-Vue, Wakefield.

An Apology.—The failure to correct our mistake in a report from our Midlands correspondent on the opening of the National Foundry College gave Mr. P. H. Wilson, O.B.E., the chairman, a wrong title. For this sincere apologies are extended to Mr. Wilson.

Major, Robinson's Jubilee

This year, the golden jubilee of Major, Robinson & Company, Limited, well-known makers of pipe- and tube-bending machines and the "Scols" range of metallic cements, will be celebrated. The present activities of the firm are carried out at the modern factory premises in Warwick Road South, Manchester, 16, shown in the illustration below. Originally, in 1904, when the firm was known as Jas. Major & Company, Limited, oxy-acetylene repair work was the principal activity. At a later date iron cement was produced with marked success. In 1911, the present title was adopted. Steady growth necessitated several moves to larger premises . . . first to Sykes Street, Manchester, then successively to City Road and Eastnor Street.

It is a matter of no small pride to the management that the company have in their employment four senior members whose services aggregate approximately 150 years, and many more of the employees have very considerable periods of association. A production bonus scheme, in which members both of the staff and works take part, has been in operation for some years. The most recent extension of the firm's activities has been the opening of a London office at Evelyn House, 62, Oxford Street, W.1.

Bell Founding*

By H. M. Howard, M.A.

The art built up over centuries of bell-founding is described and merged with modern technology. Emphasis is placed on the qualities of the casting which confer sonic excellence and tonal purity and the necessary practical foundry methods undertaken to ensure both. In the discussion, the practice of re-casting bells was dealt with, as well as the measures to promote casting soundness; proper metal composition and quality; clapper material; means of feeding and alternative metals.

History

The craft of bell-founding is almost as old as civilized man himself. The Chinese were making bells as long ago as 4000 B.C. and since that date all sorts and sizes of bells have been cast in many countries. Perhaps, rather strangely, little mention is made of bells in the Bible, except for decorative purposes and similarly, though bells were used in classical times for various purposes, they do not appear to have been of great size. Only with the growth of Christianity in Europe did church bells, such as we know them, begin to make their appearance and since the Middle Ages many beautiful examples of the founders' art have been produced.

In this country, the history of bell-founding dates from about the 10th century, when St. Dunstan is mentioned as having made bells and, later, in 1091, Fergus, a coppersmith of Boston, sometimes mentioned as the first English bell-founder, made bells for Croyland Abbey. As with many of the crafts, bell-founding in the Middle Ages was frequently practised by the Fratres Conversi, the brethren of the monasteries dealing with secular matters. Bells were, however, also made by copper- and brass-founders "brasyers" (hence the surname Brazier) who, after the introduction of gunpowder, frequently made cannon as well, as may be seen by their founders' marks.

Inscriptions cast on the bells are a traditional part of the bell-founder's art and frequently give quite interesting side-lights on current religious thought. For example, in pre-Reformation days the inscriptions were of course largely in Latin and as a rule were invocatory, such as *Sancta Maria ora pro nobis* (St. Mary pray for us). After the Reformation, inscriptions were nearly always in English and one found such inscriptions as "Prosperity to the Church of England." More material considerations prevailed in the 18th century and consequently one finds such inscriptions as "All ye of Bath that hear me sound thank Lady Hopton's £100"; or "At proper times my voice I raise and sound to my subscriber's praise." Pre-Reformation bells very seldom bore dates, but the founder and his date could nearly always be told by the characteristic founder's mark and word stops used. The practice of using a founder's marks is still always followed and bells are now dated as well.

Many of the pre-Reformation bells were destroyed and their metal sold at the Reformation and others re-cast at the beginning of the 17th century, when change-ringing started; these latter because the shape was in many cases not suitable for this purpose. Fortunately, however, quite a few bells of the 17th and earlier centuries remain and are often very good.

The 17th and 18th centuries saw the widest extent of English bell-founding and many church towers contain bells dating from that period. To select but a few of the founders' names, there were the Purdue and the Bilbie families of Somerset, the Penningtons of Devon and the Rudhalls of Gloucester, these latter from 1684 till about 1820. This firm cast the bells at St. Martin-in-the-Fields and many other rings. At Colchester, Miles Graye cast the famous tenor of Lavenham in 1625 and Christopher Hodson, who had a foundry at St. Mary Cray, in Kent, cast "Great Tom" of Oxford in 1680.

Of the three founders remaining at the present day, Mears and Stainbank claim to be the oldest, having been established in 1570 by Robert Mott, who also cast cannon for the navy at the time of the Armada. This firm, which has been in Whitechapel since its foundation, cast the 5¼-ton hour bell of St. Paul's (Richard Phelps in 1716) and "Big Ben" C. & G. Mears in 1858) and also the great ring of 12 for Liverpool cathedral. This has a 4-ton tenor bell in A*b* and is the heaviest ring of bells in the world. Taylor's of Loughborough, who also claim descent from early founders, have been at Loughborough since 1840. They cast "Great Paul," weighing 16¾ tons there in 1881 and also the ring of 12 for St. Paul's.

The Author's firm, Gillett & Johnston of Croydon, established in 1844, is the youngest of the three, but is the only English firm making both clocks and bells. Besides many rings of bells, the firm has now cast the greatest number of carillons, including two of 72 bells each. The Bourdon bell of one of these, at Riverside Drive Church, New York, weighs 18¼ tons and is the largest bell cast in England.

Moulding Methods

Various methods of moulding are known, but of these the clay-model method and the impression method are the two mainly used. Though the clay-model method, or modifications of it, was used quite a lot in the past in this country, the impression method is now the generally-accepted practice here.

* Paper read before the London branch of the Institute of British Foundrymen, Mr. B. Levy presiding. The Author is a director of Gillett & Johnston, Limited.

In both methods, the core to form the inside surface of the bell is built up with bricks and coated with loam—a sand with a high clay content mixed with cow-hair to bind it—the shape being controlled by a strickleboard or sweep, pivoted on an upright steel spindle.

In the clay-model method, a model of the bell in clay is then applied and strickled on to this core and to the surface of this is fixed wax casts of the inscription and decoration, which it is desired to reproduce. The outer mould is then formed by investing the model first by a slurry in a finely-divided state and then building up to the necessary thickness with coarser material. The whole is then stoved and in the process the wax casts melt, leaving their negative impressions in the outer mould, which subsequently become positive when filled with the molten metal. After stoving, the parts forming the outer and inner surfaces are taken apart and the clay between them removed. Mould and core are then re-assembled with the addition on the mould of the canon, or crown of loops at the top, if there is one, and the mould is ready to be cast.

In the impression method, concurrently with the production of the core, the mould to form the outside of the bell is built up in a similar way with a strickleboard but on the inside surface of a cast-iron case or "cope," each layer of sand being stoved before the application of the next one. In the final stage before casting, the moulds are given a coating of graphite to form a refractory surface and at this stage the mould cope is damped sufficiently to take the impression of letter stamps to make the inscription and also of the stamps of any decoration required. The cope is now inverted over the core and with the addition of a mould of the top, either canon or flat, leaves a space the shape of the bell to be filled by the molten metal. A pouring head with a vent for the escaping air is fitted to the top and the whole is half buried in the floor of the foundry and is then ready for pouring.

Metal and Pouring

Bell metal, which has had approximately the same composition throughout the centuries, is composed of a comparatively pure copper/tin alloy in the proportion of approximately 13 parts copper to four of tin. In character, it is a hard crystalline, and very durable metal, subject only to initial corrosion of the surface which then forms a protective coating. The addition of more tin somewhat increases its hardness and while it tends to improve the musical quality of the metal, it also makes it very brittle. The idea that addition of precious metals would improve the sound is poetic, but not true. Sterling-silver bells are reasonably musical, but gold ones, were such things economically possible, would be like those made of lead !

The metal, if in large quantities, is generally melted in a coal- or oil-fired reverberatory furnace and tapped out into a ladle when ready for casting. Smaller amounts are more easily melted in the crucible of a tilting furnace. The metal is tapped at a bright-orange heat, about 1,100 deg. C, but cools somewhat by the time it is poured from the ladle into the mould. The rate of flow into this is controlled by a conical plug and the hot air escapes through the riser or vent provided. This riser itself fills when the operation is complete, showing the mould to be completely full. Rod feeding is practised, with the object of ensuring that molten metal passes from the feeder head through the runner into the bell, so that the bell itself shall not be porous as the result of shrinkage on cooling.

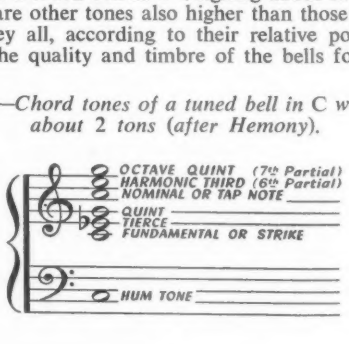
Bells up to about a ton in weight can usually be taken out of the mould on the following day but a five-ton bell takes the best part of a week before it can be handled for trimming. This operation involves the removal of the runner and riser and the metal fin at the junction of the mould and base, after which the bell is ready for tuning.

Tuning

The ambition of many of the old founders was to make a "maiden" peal with all the bells perfect in tone and tune as cast. While the results are interesting and often musically beautiful, they are also frequently deplorable and what is bad for rings of bells certainly applies more forcibly to chimes and carillons. Here, the effect is the same as if each string of a piano were entirely independent of the others, in which case recognition of tunes would become naturally very difficult. The art of bell tuning had been practised on the Continent for some time, even before it was so nearly perfected by the famous Hemony family in Flanders in the 17th Century. In this country, attempts were made by chipping metal away from the inside of the bell to adjust the pitch of bells, but it was not until Canon Simpson, Rector of Fittleworth, Sussex, in the 19th century rediscovered the principle which Hemony had used and introduced it into England, that the birth of modern tuning took place. The principle was taken up by Taylor and Gillett & Johnston, these two firms developing it into the perfected art which it has now become.

Hemony maintained that every good bell should have the partials shown in Fig. 1, which shows the tones of a tuned bell in C weighing about two tons. There are other tones also higher than those shown and they all, according to their relative positions, affect the quality and timbre of the bells for good

FIG. 1.—*Chord tones of a tuned bell in* C *weighing about* 2 *tons* (*after Hemony*).



or ill. The lowest five tones, however, give the essential harmony of the bell and it is therefore on these that the tuner mainly concentrates.

It will be noticed that, based on the *hum*, the tones, with the exception of the *tierce*, lie in the *harmonic series*. The *tierce*, however, and others higher than shown are inharmonic and the tones of a bell are in no sense harmonics of the *hum*. They correspond to different modes of vibration and hence the tuner is able to vary them, relatively to one another, within certain limits.

The bell, when cast, is roughly about a tone "sharp" of its final pitch and after testing it with tuning forks or electrical devices to find out its musical condition, the tuner decides how much metal is to be cut off and from where it is to be removed; the object, of course, being to bring all the five tones into proper relationship and down to the required relative pitch. In order to do this, the bell is clamped mouth upwards on a big revolving base-plate, and a tool which can follow the contour of the inside surface in a plane radial to the bell comes in contact with the bell and then removes the metal as it revolves. Between each cut, the bell is unclamped and re-tested and new cuts decided upon, at first heavy, but finally becoming mere shavings till the work is done. Bells of all sizes from a few pounds in weight to over 20 tons can be tuned, the only difference, of course, being the speed with which the operation can be carried out.

Experience in matching old bells from contemporary records of their condition has shown that, once tuned, little or no measurable alteration of the tone or tune of a bell takes place. The quality of old bells does, however, suggest that bells become more mellow with time. The bell after tuning is ready to be hung for whatever purpose it is required. There are three main ways in which a bell may be used, namely, to ring, to swing, or to chime.

Ringing Bells

By this is meant bells hung for change-ringing, an art peculiar to the English-speaking world and so characteristic of England that it is known as "the ringing isle." The bell moves alternately backwards and forwards through the whole 360 deg. and is checked and pulled off by the ringer at whatever moment in the change he wishes to do so. The bell, which is hung well out, *i.e.*, with the axis of suspension near the top of the bell, is hung from a timber, iron or steel headstock. Bells are sometimes still suspended from the headstocks by the canon, but more usually by four suspension bolts through the headstock and the top of the bell, which in modern bells is flat. The fifth suspension bolt in the centre also holds the independent crown staple from which the clapper is suspended. To the headstock are fixed on the one side, the wheel, and on the other the ash stay. The latter, when the bell is "up," engages with an ash "slider" pivoted at one side of the bell pit and given limited movement in a slot on the other side. This stay enables the bell to be "set" just over the point of balance in the mouth-upwards position, from which the ringers can immediately start off in full peal. Being also the easiest part of the action to replace, it is purposely made the weakest, so that in the event of too vigorous a pull it breaks and prevents damage to more important fittings. The rope which is attached to the centre upright of the wheel passes through a "garter" hole in the soling and so over the wheel and down to the ringing room over pulleys and guides. At "hand-stroke" when the ringer's hands are on the coloured woollen salley, the rope only goes a short way round the wheel, but at "back-stroke" practically right round, hence the salley is then high.

Bell frames are made of timber, cast iron or welded steel and considerable controversy exists as to which is best. Many people prefer cast iron because of its better resistance to corrosion than steel, but with the improved means of steel protection now available, the versatility of welded fabrication has attractions. The main supporting beams are now nearly always rolled-steel joists.

Swinging Bells

It is hard to say which produces the finer bell music—a heavy tuned ring of bells or several perfectly tuned swinging bells striking in harmony with one another. This method is ideal, musically, for bells weighing several tons or more, quite apart from the mechanical aspects of the question. The "surge" and the slight variation in pitch due to the sweep of a beam of sound past the listener as the bell moves produces a magnificent effect; an effect, of course, also present with a change-ringing bell. The chief characteristic of this method of hanging is that the bell is "tucked" up a long way into a heavy counter-balancing headstock, so that its axis of rotation is near its centre of gravity, the clapper being similarly treated. The result is a slow-motion effect with the clapper rising up and hitting the upper side of the bell (as it should always do) and falling away to let the bell vibrate freely. Change-ringing naturally is not possible with this type of hanging and in fact the bell does not usually swing more than frame-high. Mechanically, of course, the lateral thrust is much less than with the ringing bell. Frequently with this type of hanging, a chain passes over the wheel and round a sprocket attached to the shaft of an electric motor which provides the motive force and is in its turn controlled by an automatic switch. This form of bell music is sometimes combined with that of a chime or carillon; improvised melody on the stationary bells being fitted into the rhythm of the swinging ones hung lower in the same tower.

Chimes and Carillons

The third way of hanging a bell, which also largely applies to clock bells, is that of the chime or carillon. Generally speaking, a chime or carillon is the same thing, the only difference being in the number of bells—any number of two chromatic octaves or more being considered a carillon. The bells in this case are fixed stationarily in a frame

and chimed by an internal clapper or often in the case of clock bells by an external hammer, but the former is to be preferred because gravity here assists a quick return of the clapper. The wires from the clappers, by a system of cranks and rollers, are connected to the wooden keys of a clavier upon which a trained carilloneur may perform with great virtuosity, the wires from the bigger bells being also connected, in tandem, to pedals similar to those of an organ console. On a chime where the musical scope is not so great, the speed of action on the clavier may be sacrificed in favour of a longer stroke giving a somewhat fuller tone.

All installations of bells and carillons, after erection for test in the shop are stripped for delivery to the site. This point is mentioned to contrast the practice of some of the old founders who, because roads were so bad and bells so heavy, would build a furnace and cast the bells in the churchyard, using of course local timber for the frame.

DISCUSSION

[The above Paper was presented to a meeting of the London branch of the Institute of British Foundrymen on the occasion when they entertained as guests members of the London section of the Institute of Metals—an annual interchange of venue which has been extant for some 30 years.]

Opening the meeting, the branch president (MR. B. LEVY) first offered a welcome to Dr. Ransley and his fellow members of the Institute of Metals. Introducing Mr. Howard, he said he had been with Gillett & Johnston, Limited, for 18 years, including five years as director, and his activities had covered a very wide field of foundry practice. The many " tricks of the trade " applied to foundry work in the art and craft of bell founding would prove of great interest to members.

MR. HOWARD, amplifying his lecture, said the difference between bell founding and normal foundry practice was that there was the additional complication of bell tuning to contend with. He had talked a good deal about that rather than dealing too closely with the foundry side, which latter, he felt, would be more familiar to his audience, whereas the tonal side would be rather less known. Bells had taken many shapes through the centuries, and in the main had now become standardized into a reasonable " bell " shape. The sort of bells that were seen on Christmas cards bore no relation whatever to this shape.

Early bell-founders were often monastic or else itinerant brassfounders, who made bells as one of their lines. Bells had been made in many small foundries, often by father and son or master and apprentice, the apprentice taking over when the master became too old.

Among Mr. Howard's many illustrations was a picture of the great bell of Moscow, which was reputed to weigh 220 tons, with a diameter of 22 ft. He believed it had had a chapel inside it at one time. The sound bow, the thickest part of the skirt, was 2 ft. thick. Another illustration showed the making of a bell mould in loam. Mr. Howard said the lost-wax process was no longer used in this country for making bells, but there was no reason why it should not be used. On the Continent it was still used considerably.

In the loam-moulding process, usually a mixture of strong and weak loam was used to give a balance between avoiding cracking and ensuring sufficient strength. There was no reason why the metal should not be melted in electric furnaces. However, the expense of these methods had to be considered.

Mr. Howard illustrated the moulding, from the making of the core to the finished bell. He added that the methods of precision casting now coming into practice were going to have considerable influence on bell-founding, as undoubtedly they would have on every other foundry product.

Illustrated also was the tuning process, ringing bells, swinging bells and carillons, and the methods of hanging them. Finally Mr. Howard played a record of the sound of the " Freedom " bell, which was the outcome of an American idea that something should be created to symbolize the voice of freedom to millions of enslaved people. Gillett & Johnston had cast this bell in 1950; it measured more than 8 ft. across the mouth and weighed nearly 10 tons.

MR. D. MORRIS said that in " The History of Dartford " there was an account of the re-casting of the church bells there about 200 years ago. It appeared that the founders must have dug a hole in the churchyard, and that the loam and other materials were brought to them there. There was given a list of the materials used, etc., with the costs of the same. (The final item in this list was " Beer, 2d." !) With such a foundry method he wondered how the top part was made and how lifted.

MR. HOWARD said he did not know what was done, but imagined the founders must have had stoves on the site and must have built up some form of clay cope, which could be stoved, and then by means of tackle lifted and lowered into position.

MR. D. W. SMITH was particularly interested in a print which Mr. Howard had exhibited, showing a violin being played during the operation of tuning a bell. Presumably, he said, the tuning was being done from the harmonics of the violin.

MR. HOWARD said that very likely the various harmonics were used to multiply the possible tones the string would give.

MR. SMITH suggested that by that means the tuning would be very accurate.

MR. HOWARD agreed that it would—provided the player was efficient.

MR. SPARROW asked what was the position of the runner and ingate for the casting of a bell, and whether there was any variation of that position.

MR. HOWARD replied that normally the runner was placed centrally at the top, and the riser also came off the top at an angle. The runner was nicked so that it would be easier to break off and subsequently finish flush. He believed bells had

on occasion been cast upside down, the runners being on the sound bow; but that method would introduce a major revolution with present foundry equipment, because all the copes used were designed with the idea of running at the top.

Metal Quality

DR. RANSLEY asked what was done about metal quality and whether porosity in a bell would affect its performance in any way.

MR. HOWARD said that metal quality did affect porosity, of course, because with metals such as zinc and aluminium, which oxidized a great deal, oxide inclusions were formed which gave rise to porosity of a certain sort. The other sources of porosity, due to gas, were largely looked after in mould treatment, which was normal practice. The question of metal composition was not so much bound up with the quality of the casting, as such, as with the quality of the casting as a resonating entity. If there were too little tin, the metal would become tough and lose resonance markedly, and be weak in tone. Recently his company had had to re-cast bells which suffered from that defect. They had to turn them into rings and then drill holes in them and put wedges in to break them into pieces which could be accommodated in the furnace.

MR. J. W. BUTLER, discussing the re-casting of a bell, asked whether it was the practice to use precisely the metal of the old bell and nothing more, or whether new metal was used. If both, he asked if it were really fair to speak of "re-casting" a bell.

MR. HOWARD considered it perfectly fair to speak of "re-casting," for the founders were most meticulous in using as much as possible of the metal from which the original bell was made. It was a matter of historical honour, that any firm re-casting a bell sent the same bell back in different form. It was true that new metal had to be added to allow for wastage, and in many cases a bell was re-cast to a different weight in which case it might be necessary to add make-up metal.

Soundness of Casting

MR. N. B. RUTHERFORD, discussing the soundness of bell castings, said he had the impression, particularly from the illustration of the Great Bell of Moscow, that the sound bow was of considerably heavier section than the dome of the bell. He asked whether, with the method of top running and feeding described, the bow could be fed satisfactorily, and whether any porosity there would affect the tone of the bell. Secondly, he wondered how designers set about a new bell. Did the general shape of a bell affect its tone and pitch, or was there an agreed and accepted shape?

MR. HOWARD said the thick part of the "skirt" or the business end of the bell was called the sound-bow. The head was not entirely inert, but it was very inert by comparison with the skirt. The bell had to be suspended from some point, so that the centre of the crown used for this was, for all practical purposes, where the bell was completely "dead". Any porosity there did not make a great difference If there were any porosity it tended to be at the top, near the runner. A difficulty, particularly with large bells, was that of feeding, bebecause there was a huge mass of metal. The part at the bottom was nearly always completely sound; if porosity occurred there it would undoubtedly have a very considerable effect.

It was vital that the shape should be correct. The sound of the bell was a complex function of diameter, weight, total perpendicular height—which was in effect the length of it—of differential thicknesses and of metal composition, so that it was difficult to attribute any one factor more than another to the sound of the bell. For example, bells used as trebles of a ring of bells in a tower would be much thicker and heavier (and consequently higher in pitch) than ones of similar diameter in a carillon. This was so that they would be heard above the bigger ones. All smaller bells tended to be thicker in proportion to the larger ones.

MR. RHODES said it would appear that the metal in the skirt of the bell would remain liquid for much longer than that in the top part. He asked if Mr. Howard could explain, as a matter of founding principles, how a perfectly sound casting could be produced under those conditions.

MR. HOWARD replied that solidification occurred fairly evenly throughout. The method of feeding ensured that the runner connecting with the reservoir at the top remained liquid until the bottom part was solidified or nearly solidified. The feeding of a bell of the size of the "Freedom" bell occupied about two hours, the moulder gently stirring the metal and keeping it liquid until, by the end of his rod, he felt the bell beginning to solidify.

MR. WILSON pointed out that the skirt was so heavy as compared with the top part that there seemed to be a possibility of differential in cooling rates.

MR. HOWARD illustrated by a sketch the section of a bell from top to bottom, pointing out that in addition to probably a little extra thickness at the shoulder, there was also a fair thickness in the wall and it swelled out fairly gradually towards the bottom. Although there was fairly thick metal at the bottom, and the metal at the top might be rather thin, there was no sudden change of section and the volume was reasonably constant. Hence cooling was fairly even throughout.

MR. A. R. PARKES recalled an earlier reply by Mr. Howard to Mr. Butler that in re-casting a bell the founders were in honour bound to use as much as possible of the metal in the original bell. The speaker believed it was a fact that fairly recently Gillett & Johnston had re-cast a carillon of bells and had found that the metal of the old bells was seriously at fault, and in that case presumably they had replaced it by new metal. He asked if it were often found that old metal was of poor quality.

MR. HOWARD said it was not often found that the old metal was poor. The metal of the particular carillon which his company had re-cast had had an extremely low tin content, and the deficiency had to be made up with quite a large addition

of tin to bring the tin and copper to the correct proportions. Naturally, an arrangement had been made with the owners of the old bells about covering the extra expense because obviously the metal could not be analysed while the bells were still in the tower, which was when his firm had had to give an estimate for the job.

It was surprising how good was the quality of old bell-metal as a rule. In nearly every case the proportion of tin was very high, sometimes as high as 23 to 24 per cent., and largely for that reason the bells cracked, because with that amount of tin they were very brittle.

Clappers

MR. MACGREGOR asked if any particular metal was used for the clappers and whether there were any particular features about their shape.

MR. HOWARD replied that that was quite important. Various metals had been used, but it was found that wrought iron was generally best for ringing bells, not so much from the point of view of tone, but because it had to be strong enough to withstand the very considerable impact of the clapper of a ringing bell. Cast iron was used mostly for carillons and chimes; it was about as good a metal as any for that purpose because sonically it was very inert and all the momentum of the blow was transferred to the bell and not retained in the clapper. He believed a bell-founder in Holland had used inserts of manganese-bronze; but he himself did not think there was anything better than cast iron. As a matter of fact the "Freedom" bell had a wrought-iron clapper, although on that type of swinging bell very often a large cast-iron disc was used, suspended between two parallel shafts, and it did the same duty.

A MEMBER asked whether Mr. Howard had any experience of bells cast in light alloys. He believed a carillon in light-alloy metal had been cast in Sweden some time ago, and he also understood that the bells made in that country were a half-tone different from the "Freedom" bell. Coming back to the actual casting of bells, he could not quite follow the explanation that the metal was just cast in at the top. Did it run down only one side of the bell or did it run all round the bell and fill up all the way round? In the case of large bells it would seem that a very large amount of metal surface was exposed while running. As he visualized it, the metal tended to distribute itself at random over the whole inside surface of the core.

MR. HOWARD said the only experience he could give with regard to the use of light alloys for bells was that his company had cast a bell in aluminium experimentally, and, although the tones were normal because the bell was of normal shape, the resonance was so short as not to be practical. He did not say that that would be the result with all light alloys; but in the experiment he had mentioned probably the normal DTD-424 metal was used and gave this result.

With regard to the flow of the metal when pouring, he said the metal impinged on the top of the core and splashed out evenly in every direction, so that it ran down the surface of the core on every side. It usually splashed a little on to the inscription band, and that and the top of the core had to be very well sprigged with nails to ensure that the mould remained firm.

MR. D. MORRIS asked if Mr. Howard used any exothermic material to aid feeding at the top, in order to do away with rod feeding.

MR. HOWARD replied that he had done so in the case of small bells; but this material was not cheap and the amount required to feed a really large bell made its use rather prohibitive, so that he retained the rather archaic but cheaper method. Furthermore, it was found that the heat generated was too great. In this connection, Mr. Howard remarked that his company had shell-moulded smallish bells of up to about 40 lb. in weight. Here, of course, the metal was kept hot by the burning of the resin in the mould.

Vote of Thanks

MR. A. R. WIZARD, proposing a vote of thanks to Mr. Howard, said it had been a great pleasure to listen to him and to see his illustrations. By inviting him to lecture, the branch Council had demonstrated just how complicated an industry the members served. What an interesting lecture Mr. Howard had given! How refreshing it was to find that there were men still making castings, apart from commercialism, to give music to the world! It was extremely interesting to realize that the method of casting was not complex, as castings go, but it was dangerous from the point of view that if a waster were produced it represented a great loss in value. He wondered what the feelings of the foundry manager were when he came across a waster.

DR. RANSLEY, as chairman of the London section of the Institute of Metals, seconded, and also took the opportunity to express appreciation on behalf of the section for the hospitality extended to its members; they did really appreciate these annual joint meetings. The interests of the branch and of the section overlapped in one or two fields, and that evening they had heard a lecture which appealed to both bodies. He had come to the meeting abysmally ignorant of both bells and bell ringing, his only preconceived idea being that sonority was not a good line so far as aluminium was concerned.

MR. HOWARD, responding, expressed his appreciation of the generosity with which his lecture had been received and of the kindness of the proposer and seconder of the vote of thanks. He confessed that at first he had felt highly nervous about addressing so august an assembly comprising so many experts in foundry matters; the only trump card he had up his sleeve was the knowledge that most of his audience would not know very much about bells, even though they knew a lot about other branches of foundrywork.

Quantity Production of Engineering Castings*

By J. Burrell

(*Continued from page* 155)

Diesel-engine Cylinder Blocks

Undoubtedly one of the most difficult castings to produce and certainly one which has to undergo the most rigid inspection is a Diesel-engine cylinder block and the one dealt with is no exception. The casting to be described is for a single cylinder 40 h.p. tractor engine of the two-stroke loop scavenger type and is illustrated in Fig. 12. This shows an unmachined casting weighing 3 cwts., but as very little detail is shown on this view, castings have been sectioned to illustrate the port arrangements of the cylinder.

Fig. 13 shows fully-machined cylinder block castings which have been sectioned, the centre piece having been split at right angles to the joint line to show the inlet and exhaust parts relative to each other. The section of the casting shown on the left of the picture shows the exhaust parts and that on the right the inlet parts and these sections together form a complete casting which has been cut along the joint line.

Since the ports do the work of valves, their position, shape and angle of entry into the main bore of the cylinder are of vital importance to the efficiency of the engine. Small variations in any of these set dimensions results in loss of horse power, and for this reason the foundry must work to very close limits, a tolerance of plus or minus 0.030 in. being allowed on the cylinder head face-inlet port dimension.

Another difficulty (and perhaps the most serious) with this casting is the fact that no provision is made for a liner, which means that the main bore must be free from the most minute of defects and must machine to a very high polished finished by honing. The water jacket is tested at 40 lb. per sq. in. water pressure.

Although many thousands of these blocks have now been successfully produced, it must be admitted that this job severely taxed the ingenuity of the foundry staff in the early days of production. It is now a routine job running with a low incidence of scrap but very strict supervision in all its stages of production is still maintained.

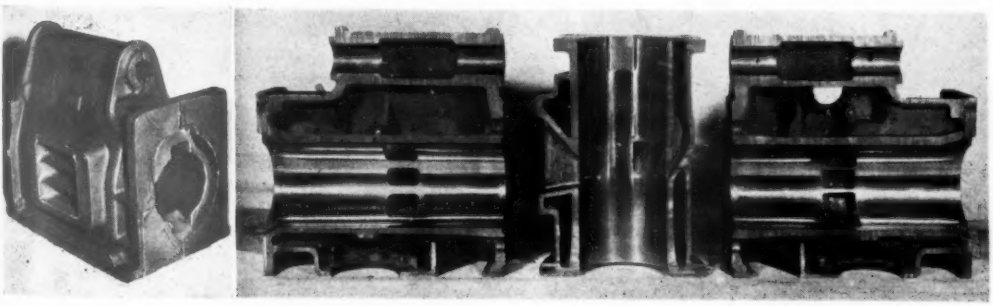
The pattern and corebox equipment which is metal throughout is illustrated in Fig. 14 and a complete set of cores is shown in Fig. 15. All the cores are made with synthetic-resin sand and great attention is paid to venting, especially of the main barrel and jacket cores. Since it is essential that the vents of the two jacket cores link up on assembly, these are positively located in each corebox. In view of the necessity for a perfectly clean casting, considerable attention is paid to the running system, and a filter runner incorporating the use of a carbon block has been developed. This runner core is shown as an "L" shaped core on Fig. 15; the carbon block replaces the normal core sand filter runner and is simply a block of graphite into which are drilled holes of a predetermined size and number and rammed up in the corebox. The use of such a filter obviates the possibility of sand wash from the filter core and has certainly justified its application to this job.

Core and Mould Assembly

The importance of shape and position of the inlet

* Paper presented to the Lincolnshire branch of the Institute of British Foundrymen. Mr. Killingworth presiding. The Author for the last nine years has been in charge of the foundry of Marshall Sons & Company, Limited, Gainsborough.

FIG. 12 (LEFT).—*Casting for a single-cylinder* 40-*h.p. tractor engine, weighing* 3 *cwt., and* FIG. 13, *similar castings fully-machined and sectioned to show inlet and exhaust ports relative to each other.*



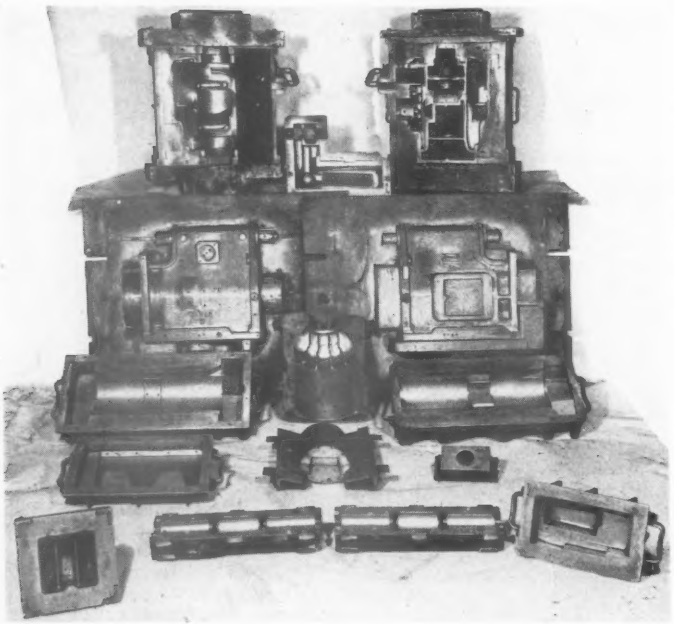


FIG. 14.—*Pattern and corebox equipment for the cylinder block shown in Figs.* 12 *and* 13.

ports has been stressed and since the inlet port core is located by a print into the barrel core this is assembled in a jig, illustrated in Fig. 16. The use of this jig ensures that the barrel core is concentric and that the inlet port is in its correct seating in the barrel core print. The port core is removed from the barrel before assembly in the mould so as to enable the print on the barrel core which locates the ports, to be set by means of a template.

Fig. 17 which shows the mould assembled up to the joint illustrates the use of this template and it will be seen that the core print in question is set from the location pin hole in the moulding box lug.

Clearance is allowed on the barrel core end prints to allow the core to be moved to its correct position and set by the template. The vents connected by grips on the joint face of the bottom water jacket core which match up with vents in the top jacket core are illustrated and the runner core is seen in position.

Fig. 18 shows the drag mould fully assembled ready for the cope, the sealing of vents and positioning of studs being clearly indicated. So as to avoid the possibility of metal entering the core vents at the joint of the mould, these are brought out below the joint at the ends of the barrel core by means of a vent wire and make up with sand. The need for trying the top box on the mould is

FIG. 15.—*Complete set of cores made from the equipment shown in Fig.* 14. *The L-shaped core carries a carbon block instead of a filter runner.*

avoided by the use of a bridge template which indicates the correct stud thicknesses and print clearances without the risk of damage to the mould. The use of this template is shown in Fig. 19.

No chances are taken with this cylinder-block casting; it is cast in dry sand and the whole runner system is made in cores to enable dressing to be applied. The runner basin which is of large dimensions is also of core sand, plugs are used so that the basin is kept filled during pouring and is then allowed to drain so that a good run-through of metal is obtained.

Piston for Single-cylinder 40-h.p. Diesel Tractor Engine

This casting, which has a rough casting weight of 66 lb., calls for a very high degree of machined finish so that it is essential that the structure should be very close grained. Fig. 20 shows a fully machined casting, the high polished finish being well illustrated. The machined casting is 6½ in. dia. × 11½ in. long and it will be appreciated that minute flaws are sufficient to cause castings to be scrapped.

Production Method

Fig. 21 shows the type of pattern and corebox equipment used. Four split patterns are mounted on plate and the main body core takes the form of a cover core. The downsprue and print for the location of a filter core are mounted on the cope pattern plate, and the runner bar and ingates for the spray of four castings mounted on the drag pattern plate. The castings are in this way run tangentially on the bottom joint through a filter core.

With the decision to gate these pistons at the bottom, the difficulty arises of having to use a cope box without bars, and as it is the author's policy to cut out the need for gaggers wherever possible, the sand is held in the box during drying by bolting a plate on the joint face of the box before the turnover and stripping operation.

The plate can be safely removed after the mould has been dried, the cores set in the mould and checked for concentricity from the joint face and then the closing operation completed. Fig. 22 shows a top part mould with the plate removed and core setting being checked in this way; Fig. 23

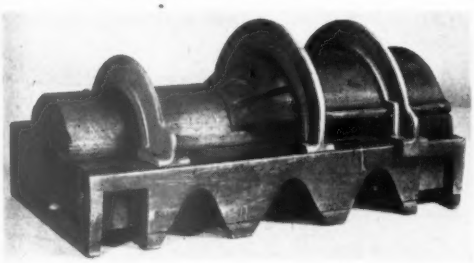


FIG. 16.—*Jig for ensuring that the barrel core is concentric with the mould.*

FIG. 17.—*Method of mould assembly whereby the setting of the core is gauged from a pin-hole of the moulding box.*

FIG. 18.—*Drag mould of Fig.* 17 *fully assembled and ready for the cope; sealing of vents and positioning of chaplets can be seen.*

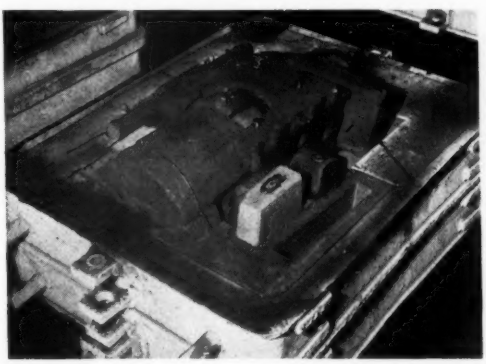
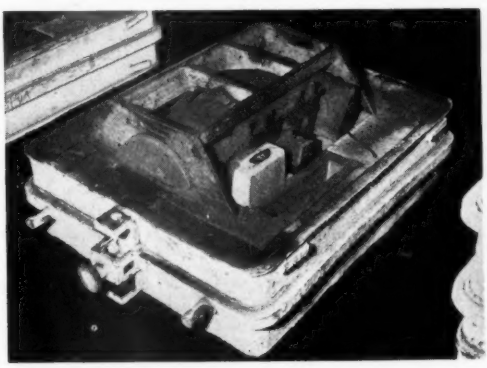


FIG. 19.—*Use of a bridge template for indicating the correct stud thickness and print clearance.*



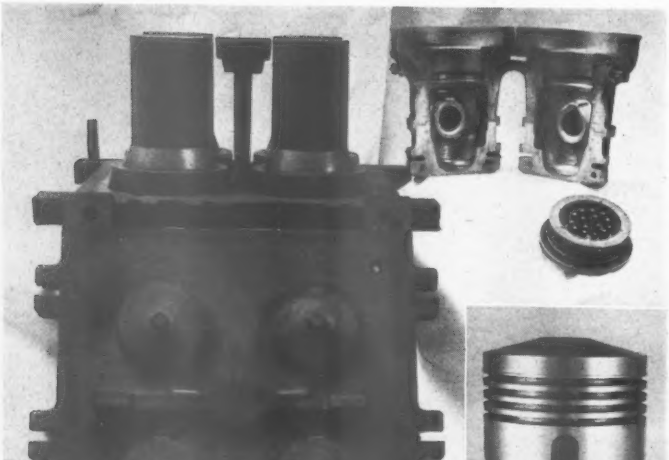
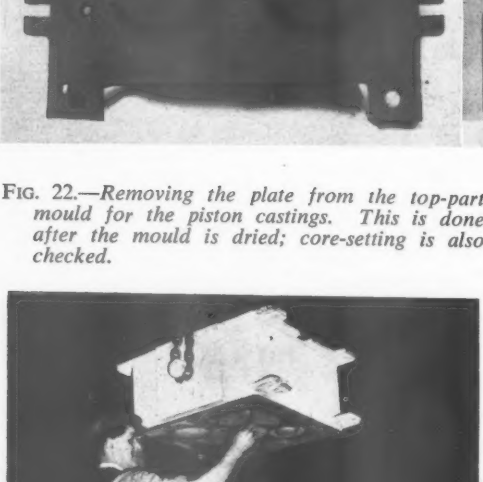


FIG. 20 (INSET). — *Fully-machined piston for a 40-h.p. Diesel engine weighing 66 lb. and* Fig. 21.—*Pattern and corebox equipment for making the piston shown in* Fig. 20.

FIG. 22.—*Removing the plate from the top-part mould for the piston castings. This is done after the mould is dried; core-setting is also checked.*



illustrated a spray of rough castings showing the strainer core at the bottom of the downsprue; and Fig. 24 shows a spray of castings incorporating the runner bar and ingates. Over 30,000 of these pistons have been successfully produced.

Tractor Gearbox/Crankcase Casting

Fig. 25 shows a tractor gearbox; over 25,000 of this type of casting have been produced from the plant and it is still in regular production. The casting weight is 6½ cwt. As very little clearance is allowed for the connecting rod, crankshaft and gears, the foundry must work to very close limits on the inside dimensions of the casting. In this connection, the use of the core-stripping machine has proved of great advantage in the production of the main body cores for this job. In a casting of this type where the demand has been considerable, two or three sets of the main coreboxes have been in use at one time with different coremakers on each box, and when hand stripping was used, considerable variation in dimensions of cores from individual operators caused difficulties in assembly. With the installation of the core stripping machine cores of constant dimensions are now obtained.

The gearbox/crankcase casting forms an integral part of the body of the tractor and it must therefore be of good quality material and free from defects of any kind.

Production Method

The pattern equipment together with a complete set of cores is shown in Fig. 26, from which it will be seen that the pattern is split on the same line as the main body cores thus simplifying mould assembly, and the casting is gated into the bottom face by extending the ingates down the back of the side core prints. It is of the utmost importance that correct metal sections should be maintained, and since this casting is " jigged up " for subsequent machining operations, accurate core setting is necessary. This is achieved by the use of simple templates when assembling.

Fig. 27 illustrates the mould assembled to the joint and the crankcase end of the bottom body core being set into its correct location by the use of a template. This template checks the core for height and sets it in correct position transversely;

correct positioning longitudinally is obtained by the use of a thickness setting piece at the other end of the core. Since the centre of the crankcase print is the datum point from which all machining operations are carried out, the importance of the correct setting of this core will be appreciated. Obviously, if this core is incorrectly located, all bores, etc., in the casting will machine out of position.

The runner bar and downsprue wells which are located behind the core prints of the main body core, are seen in the foreground and since this type of runner system obviously restricts to some extent, natural venting through the side prints, two main vents are brought from the centre of the bottom main body core to the joint face. These vents which have been marked with white chalk to clearly indicate their position, match up exactly with vents in the top body core to give clear passage through the top of the mould to the gases created during casting. The correct position of these vents is ensured by positive location in the coreboxes.

The fully assembled mould ready to receive the cope is illustrated in Fig. 28 and the main vents on the top of the main body core can be clearly seen. Since much time can be wasted and considerable damage done to a mould by offering on the top box to check print clearances and stud thicknesses, the use of a closing frame has been adopted to all work on the medium-heavy moulding section.

The use of such a template is illustrated in Fig. 29 and shows a completed crankcase-gearbox mould being checked in this way. The template is actually an exact replica of the cope part mould, all core print locations and metal thicknesses being allowed for on the frame.

The moulding box closing-pin holes are used as locations and the use of this type of jig removes the possibility of crushes and ensures correct metal thicknesses without offering-on the top box.

Diesel-engine Flywheels

The production of Diesel-engine flywheels which require to be balanced to very close limits can give rise to many problems when quantity production is undertaken. The normal methods of feeding by the use of ferrostatic heads or risers are usually successful when producing in small quantities, and the proper use of rod feeding may also be successfully applied. When, however, these castings require to be produced in large batches, very serious trouble can result due to shrinkage or porosity under the feeder heads arising from variations in metal temperature and composition. The removal of heavy feeders can also be an expensive fettling operation, and although efficient feeding is obtained by the use of sleeves of proprietary exothermic re-acting materials, these are also expensive.

When quantity production of high speed Diesel-engine flywheels was first undertaken on this plant, some of the troubles mentioned were experienced, and after carrying out a series of trials on our range of disc-type flywheels, the management standardized on the method of "controlled pouring" and dis-

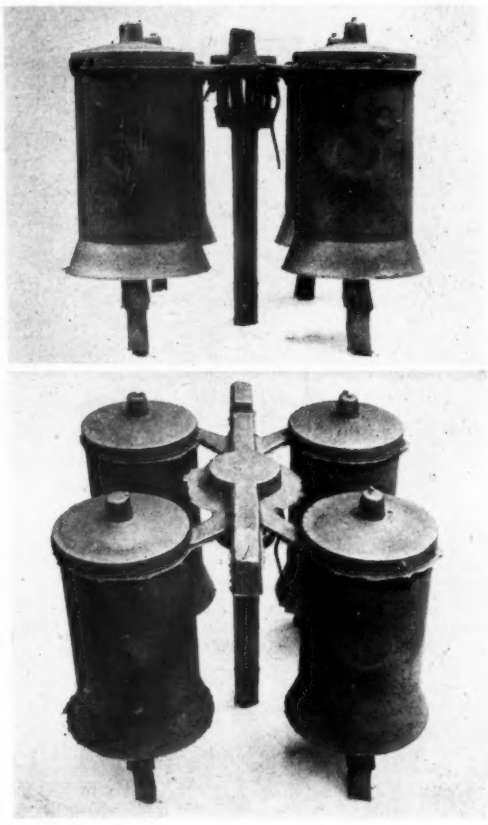


FIG. 23.—*Spray of piston castings inverted after knocking-out, showing the filter core at the bottom of the downgate; and below,* FIG. 24, *same spray of castings as in Fig.* 23, *tilted to show the runner-bar and ingates.*

FIG. 25.—*Gearbox/crankcase casting weighing 6½ cwt., over 25,000 of which have already been made. A core-stripping machine on this job has removed errors due to the human element.*

FIG. 26.—*Pattern equipment and a complete set of cores for the gearbox/crankcase casting shown in Fig. 25.*

pensed completely with all feeder heads on this type of work.

The method is to run the mould very slowly so as to reduce temperature gradients in the casting and thus by removing "hot spots" dispense with the need for feeders. The application of this method is illustrated by reference to the following description of the production of two flywheel castings of widely varying weights.

Diesel Tractor-engine Flywheel

This casting is shown in Fig. 30 in the fully machined condition and weighs 6 cwts. It requires to be very accurately balanced and when originally produced with three feeder heads much trouble was experienced due to porosity under the risers. It is now successfully produced by the method outlined below.

The pattern equipment is shown in Fig. 31 from which it will be seen that the use of a cover core is applied. The casting is run into the top of the rim through two filter cores, the runner pegs incorporating the filter-core prints being rammed up in the cover corebox in the positions indicated by dowels in the box. Since the casting is poured very slowly, the filter core is exposed to severe conditions of heat and erosion and for this reason a carbon block is used into which the necessary number of holes are drilled. In this instance two carbon blocks are used with three $\frac{3}{8}$ in. dia. holes in each, giving a total ingate area of 0.66 sq. in. to give a pouring time of 85 to 90 seconds.

The mould is skin dried and a machining allowance of $\frac{1}{8}$ in. is allowed on the top face, this allowance also allows for "sinking" which may occur on this face.

Since the base of the runner basin is formed by the top side of the cover core, a "hot-spot" on the top face of the casting could be expected to occur which would result in local excessive "sinking" and to obviate this, the runner basin is tapped off immediately after casting.

Oil-engine Flywheel

Fig. 32 shows an oil-engine flywheel casting weighing 26 cwts. the dimensions of which are 55 in. dia. by $8\frac{1}{4}$ in. face. Quantity production of this casting has been successfully undertaken by the application of the "controlled pouring method." The runners have been left on the casting to show the method adopted in this instance. The two ingates which will be seen to enter tangentially are fed by carbon block filters through short downsprues. (The filter blocks are hidden in the illustration by the thin crust of metal left in the runner basin.) Five $\frac{3}{8}$-in. dia. holes are drilled in each filter block giving an effective runner area of 1.1

FIG. 27.—*Gearbox/crankcase mould assembled as far as the joint. A template is used to check the setting of the crankcase end of the body core.*

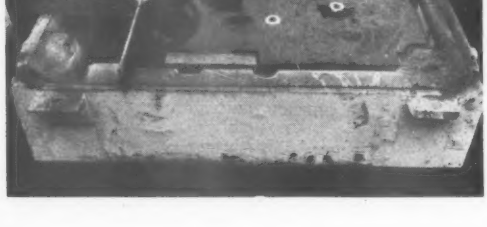


FIG. 28.—*Assembled mould ready to receive the cope. The main vents from the top of the body core can be seen.*

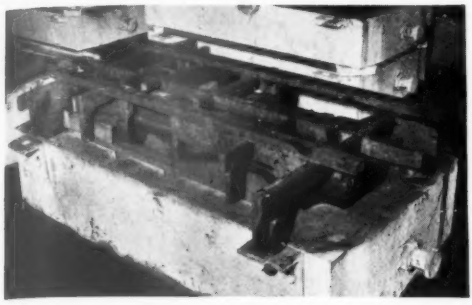


FIG. 29.—*The use of a template—a replica of cope mould—ensures the correct metal thicknesses and checks the locations of the core-prints.*

sq. in. and a pouring time of 2½ minutes. Wheels of this type have been successfully produced by this method ranging from 2½ to 26 cwts.

In the early trials of the application of this method of gating, two main difficulties were encountered and until these were overcome very little success was achieved.

(1) It will be appreciated that the filter runners are subjected to much more severe conditions than when running at normal speeds and the Author was unable to develop a core-sand which would stand up to these extreme conditions. Invariably, the pencil holes in the filter core would increase in size during pouring with the result that control of the pouring speed was lost. For this reason he standardized on the use of carbon blocks as previously mentioned with considerable success.

(2) It was obvious that with this method of running there would be a great tendency for the formation of scabs or buckles on the top face of the casting, and it would be necessary to reduce the expansion characteristics of the facing sand on the cope part mould. Some considerable trouble was experienced before this problem was finally overcome and of the materials tried, core-sand with the addition of 1½ per cent. wood flour has been the most successful. The management has now standardized on the use of this mixture for the facing of all cope part moulds when applying this method.

The castings reviewed represent a fair cross-section of the type of work produced from the medium-heavy section of the plant, and in a general way indicate the methods of production applied.

FIG. 32.—*Oil-engine flywheel, weighing* 26 *cwt., which was cast by means of a "controlled pouring method." The runner bar and ingates are still attached.*

Summary

To summarize; methods of production used may be considered to be based on several fundamentals:—

(1) All castings, wherever possible, are run into a bottom face, care being taken to avoid impinging on cores so as to eliminate turbulence and core scabbing.

(2) Exceptions to this rule are castings of the flywheel type where "controlled pouring" is applied and top running adopted wherever possible.

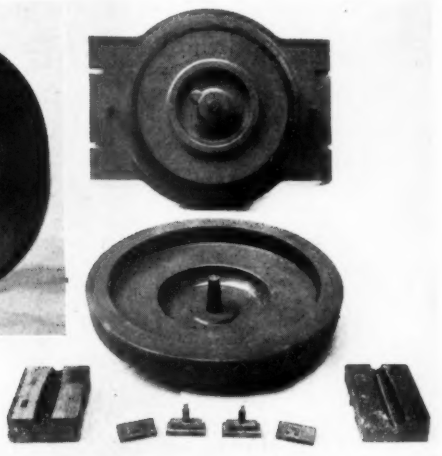


FIG. 30 (INSET).—*Diesel-engine flywheel, weighing 6 cwt., after complete machining.* FIG. 31.—*Pattern equipment for the flywheel shown in Fig.* 30. *A cover core is used to complete the assembly*

Quantity Production of Engineering Castings

(3) Considerable attention is given to core venting and the location of vents is catered for in the coreboxes wherever possible.
(4) Controlled runner systems are always used and receive as much attention as the mould itself, being considered part of the mould proper. Dirt traps are incorporated in all runner systems.
(5) The use of jigs or templates of simple design is extensively applied for core setting.
(6) All methods are pre-planned before production begins and records are kept of all methods used, including unsuccessful ones.

As explained in the opening remarks, faced with a production problem in 1945, the foundry has, with the help of a minimum of mechanization and by making modifications to production methods, successfully met the demand for increased production.

No claim is made to output figures comparable with those obtained from a fully mechanised plant, but in consideration of all the factors involved (*viz.* type of work, comparatively small batch quantities and frequency of pattern changes) it is felt that investment in the type of plant described was economically sound.

If these conditions are appreciated, and if the Author has succeeded in demonstrating to readers the theme of "increased production by the application of limited mechanization", then he feels that this Paper may have achieved its purpose.

In conclusion, the Author expresses his appreciation to the directors of Marshall Sons & Company, Limited, for their permission to publish this Paper.

Pig-Iron and Steel Output

Steel production in January was at an average weekly level of 360,300 tons—the highest January figure ever recorded. It compares with a weekly average of 346,300 tons in the first month of last year. The annual rate of output last month, at 18,737,000 tons, was near to the peak rate of output achieved last November, when the annual rate was 18,878,000 tons.

Pig-iron output last month was at the highest annual rate ever recorded of 11,941,000 tons. The previous highest was attained last November, when the annual rate was 11,883,000 tons. Last month's average weekly output of pig-iron was 229,600 tons. Latest steel and pig-iron output figures compare as follow with earlier returns:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1954—January ..	229,600	11,941,000	360,300	18,737,000
1953—December ..	225,400	11,723,000	338,900	17,624,000
November ..	228,500	11,883,000	363,000	18,878,000
January ..	213,900	11,121,000	346,300	18,009,000
1952—December ..	206,300	10,728,000	313,700	16,314,000
November ..	206,800	10,753,000	345,200	17,952,000

Fostering Industrial Invention

The rich to-day—idle or industrious—are certainly not as rich as they were. Rapidly the patron of the arts or science is disappearing and his good work, if it is carried on at all, is being left more and more to corporate organizations. Sir Edward Appleton, Principal of the University of Edinburgh, was concerned with the financing of industrial invention when he addressed the Edinburgh and District Local Centre of the Institute of Bankers in Scotland last week. It was clear, he said, that this country would only prosper if we were able to go on pioneering new commodities and new ways of production.

The wealthy individual who could afford to pay for the necessary technical advice and could afford to take risks had almost disappeared, commented Sir Edward. His private savings were now compounded in the funds of the big organizations, the insurance companies, and the large industrial concerns. While he conceded that insurance companies might not be expected to risk clients' money, he suggested that every company in possession of surplus reserves should be ready to employ some part of such reserves in financing promising new inventions and processes.

Of the organizations which had done much to nurture inventive genius, Sir Edward praised the work of the National Research Development Corporation, whose functions were now being widened.

Nevertheless, while research was protected by tax concessions on non-capital and capital expenditure, Sir Edward felt that, in the case of smaller firms at least, we were hampered by present taxation in that there was no similar relief at the next logical stage—production. He hoped that the Royal Commission on the Taxation of Profits and Incomes, which was now sitting, would be alive to these matters.

Plea for Taxation Reduction

Another memorandum calling for an incentive Budget again this year has been forwarded to the Chancellor of the Exchequer. At the end of last year the Association of British Chambers of Commerce in its annual letter to the Chancellor asked for a further reduction in taxation to encourage the growth of enterprise in business and industry. This cry has also been taken up by the Federation of British Industries, which, in its customary advice to the Exchequer, stresses the need for "a stimulus to further saving and a hope of greater reward for successful enterprise." The Federation is of the opinion that the procedure adopted in 1953 was the best method to achieve the maximum incentive in return for the sacrifice of revenue, namely to give a substantial aggregate relief, between direct and indirect taxes.

The hope that the Chancellor will again aim at only a moderate surplus in 1954-55 and that a determined effort will be made to reduce the total of Government expenditure, is expressed by the Federation. A cut in income tax, it is contended, would provide a stimulus that would reach a wide range of taxpayers, both individuals and companies, with beneficial effects.

Speaking of the growing competition in export markets, the F.B.I. memorandum says that enough has not yet been done to increase exports, the volume of which barely surpasses the figures of the previous year, although world trade as a whole has increased. It is essential that our resources should be used more effectively, productivity increased, and costs reduced, it declares.

Moulders Lose Court Case

Principles at Stake

A claim for 7s. occupied Judge Hamilton and two counsel for more than three hours at the last Rugby County Court. It was made by a workman against the B.T.H. Company Limited, and was for wages said to be due as payment for "standing-in" time during which work was not done because of a dispute. The plaintiff was Mr. P. J. Fisher, a machine moulder.

Mr. W. A. L. Allardice, who represented Fisher, in opening the case, said that it involved principles which were of great importance to workmen. The plaintiff was first engaged by B.T.H. as a labourer, and about a year later was up-graded to a machine moulder. There was no written contract. When labour was plentiful, the knocking-out of boxes in which castings had been made was carried out by labourers, but since 1941, machine moulders had done their own knocking-out, simply as an act of grace without being contractually bound to do it.

In June, 1951, a dispute arose over another matter and Mr. Fisher told his foreman, Mr. Tolcher, that he and the members of his section did not propose in future to do the labouring. The plaintiff had reason to believe that Mr. Tolcher was going to put on labourers, and that Mr. Tolcher accepted his point of view. No labourers came, and Mr. Fisher and his fellows were given pass-outs after being at their work for six hours the next day.

Points at issue

The principles involved were: Could a machine moulder refuse to do the work of a labourer; what would be the authority for absolving him from doing the work if he had received an order to do the work which he suggested he had not; and whether on that basis the employers should pay him. It was the plaintiff's contention that if the employers kept a man at the works without giving him a pass-out he was entitled to be paid for "standing-in" time.

Mr. Fisher, in evidence, said he was a member of the National Union of General and Municipal Workers and the B.T.H. was a federated establishment. He was a shop steward which meant that he spoke for about 50 machine moulders if any of them had a grievance with the company. When the dispute arose he told Mr. Tolcher that the section was prepared to do their own labouring as in the past; and that one pair of men who were doing nothing but labouring would do nothing but machine moulding. Mr. Tolcher said the shop would not run for long on those lines. Mr. Fisher added: "We were at our place of work, sitting and talking doing no work from 7.30 a.m. till 12.30 p.m. and from 1.30 to 2.30 p.m. when we were given pass-outs by Mr. Tolcher endorsed 'Refusing to resume normal working.' For the six hours no payment was received by any of us."

Representing the defendants, Mr. A. W. M. Davies, submitted that the issue was a simple one. The plaintiff had a contract of employment with the defendants, part of it being to obey the lawful commands of the manager or his assistants. The plaintiff refused to do work; he had no ground for refusing. Quite apart from the rules, it had been the practice for ten years, and still was, for machine moulders to do the knocking-out work. The defendants could in Common Law have dismissed the plaintiff on the spot at 7.30 a.m. on June 5.

Mr. Allardice then made his submission, in the course of which the Judge interrupted him to say: "It is an amazing picture—twelve men on June 5 and at least half a day on June 6 just sat and talked instead of doing this knocking-out which they had done for years before and which they have been doing ever since—it seems to me to have been a matter of *ultimatum* not of *negotiation*.

In the course of his judgment, His Honour said that one remarkable feature of the case had been that no witness who was a moulder had been called on behalf of the plaintiff. It was quite clear that for ten years before the event, and also since, machine moulders had knocked-out boxes as part of their work. It was past his comprehension, and it was difficult to imagine a more pathetic picture than twelve able-bodied men sitting and talking from 7.30 a.m. to 5.18 p.m. on June 5 and from 7.30 a.m. to 2.30 p.m. on June 6. The abrupt and sudden intimation to Mr. Tolcher at 7.30 in the morning was the first notice to the employers that that attitude was going to be taken.

Judge's Findings

The Judge found that Mr. Tolcher, on both days, told the men that they would not be paid if they did not do the knocking-out. The plaintiff laid himself, and the other eleven men also, open to be dismissed on the spot when he suddenly and starkly refused to work except on his own terms. They were not dismissed and it appeared to His Honour that the defendant company had behaved with great restraint and generosity. The plaintiff's claim failed entirely. He was not ready and willing to work during those six hours or to carry out the contract of his employment, which included knocking-out boxes. He was willing to work on a different footing, pursuant to a contract which was not in existence and which he sought to set up and establish.

With regard to the counter-claim, with its set off, it was abundantly clear that the defendants could have made a very substantial one against Mr. Fisher and the eleven men. They had not sought to set off any more than the amount of the claim and thereby acted very generously.

There was no order as to costs. During the hearing of the case it was stated that owing to the dispute production amounting to nine tons of castings was lost.

"Ideal Home" Exhibition

In a specially-constructed showcase on a stand in the main aisle of the Grand Hall at Olympia £1,000,000 worth of diamonds will be on view, when the *Daily Mail* "Ideal Home" exhibition opens on March 2 (until March 27). Close to this exhibit are to be models of many kinds outlining the history and evolution of the diamond.

There will also be a working model of the Premier Mine, the most modern in the world and also visible the manner in which shafts are sunk near the volcanic "pipes" where horizontal tunnels are bored into the diamond-bearing blueground. No less than 75 per cent. of all diamonds mined are of such poor quality that they cannot be used for jewellery.

The cutting of a stone of average size may take from half a day to two days and a big one may take a fortnight. The sawing is done with a wafer-thin disc of phosphor-bronze, spinning at 5,000 revolutions per minute and the actual cutting is done by diamond dust and oil. The loss in cutting a stone may be as high as two-thirds; that is to say, a stone may "deliver" about 40 per cent. of its original bulk even if in extraordinarily fine shape to begin with.

British Blast Furnaces in the December Quarter, 1953

(These tables are published through the courtesy of the British Iron and Steel Federation.)

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the fourth quarter, 1953.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Clay Cross	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	—	3	—	3	3	4
Kettering Iron & Coal	—	—	2	—	2	2	2
New Cransley Iron & Steel	—	1	—	—	1	1	2
Renishaw Iron	—	—	2	—	2	2	2
Sheepbridge	—	1	1	—	2	2	2
Stanton Ironworks: Stanton-by-Dale	—	—	5	—	5	5	5
Staveley Iron & Chemical	—	—	4	—	4	4	4
Stewarts and Lloyds: Corby	—	4	—	—	4	3.9	4
Wellingboro' Iron	—	2	—	—	2	2	3
TOTAL	—	8	19	—	27	26.9	31

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel	—	1	—	—	1	0.9	1
Darwen & Mostyn	—	—	—	1	1	1	1
Lancashire Steel Corp'n.	—	2	—	1	3	3	3
Summers, J.	—	1	—	—	1	1	1
TOTAL	—	4	—	2	6	5.9	6

North-West Coast.

Barrow Ironworks	2	—	—	—	2	2	4
Charcoal Iron	—	—	1	—	1	1	1
Millom & Askam	2	—	—	—	2	2	3
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	6	—	1	1	8	8	11

Lincolnshire.

Appleby-Frodingham	—	6	—	—	6	6	6
Lysaght's Scunthorpe Works	—	4	—	—	4	4	4
Thomas, R., & Baldwins: Redbourn	—	2	—	—	2	2	3
TOTAL	—	12	—	—	12	12	13

North-East Coast.

Consett Iron	—	3	—	—	3	2.7	3
Dorman, Long: Acklam	—	3	—	—	3	3	4
Redcar	—	2	—	—	2	2	2
Cleveland	—	2	—	—	2	2	4
Bessemer	—	3	—	—	3	3	3
South Bank	—	—	—	2	2	2	3
Gjers, Mills & Co.	2	—	—	—	2	2	5
Normanby Ironworks	2	—	—	—	2	2	3
Skinningrove Iron	—	2	—	—	2	2	3
South Durham Steel & Iron:							
West Harlepool	—	2	—	—	2	2	2
Cargo Fleet	—	2	—	—	2	2	3
TOTAL	4	19	—	2	25	24.7	35

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	1	—	3	3	5
Carron	—	—	1	—	1	1	4
Colvilles	—	3	—	—	3	3	3
Dixon's	—	2	—	—	2	2	6
TOTAL	1	6	2	—	9	9	18

South Wales and Monmouthshire.

Briton Ferry Works	1	—	—	—	1	1	1
Guest Keen Baldwins: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	2	—	—	2	2	2
Steel Company of Wales: Margam	—	3	—	—	3	3	3
TOTAL	2	7	—	—	9	9	10

U.K. Can Supply Capital Goods

Britain is now in a good position to supply the growing capital needs of the sterling-area market. The difficulties with steel are almost over, the defence programme has levelled off, and in most capital goods industries orders can now be delivered as quickly from here as from foreign competitors. The latest Treasury Bulletin for Industry reveals that the U.K. is easily the biggest supplier of machinery and transport equipment to the rest of the sterling area. It points out, however, that there are still quite considerable supplies from the dollar area, and other European supplies have increased a little in the last two years.

The bulletin says that Australia and New Zealand were responsible for the 1953 recovery in U.K. exports. Comparing the second half of 1953 with the first, exports to Australia and New Zealand rose by 31 per cent., and those to the rest of the independent sterling Commonwealth by only 2 per cent. Vehicles were recovering their sales in the independent sterling Commonwealth, but sales of metals and other engineering goods were falling up to September. As regards agricultural machinery, the U.K. can now supply all types of farm machinery, including some obtainable until recently only in the U.S.

Although there was some improvement in exports to the sterling area in the second half of 1953, the bulletin warns that competition is already keen and can be expected to increase. Success will depend increasingly on the excellence and price of the product and on the

efforts made by exporters to push their sales overseas. Exports to the sterling area, it is added, have fallen sharply since 1951, but much of this has been offset by industry's success in expanding other markets, particularly in Europe.

Midland Productivity Scheme

Birmingham Productivity Association, formed six months ago, is this month launching on a small scale a scheme of inter-works visits and discussions that, it is hoped, may do something to break down the traditional barriers of reticence in industry, and lead to a wider pooling of ideas and improved methods. An experimental "pathfinder" scheme of factory tours and talks among technical representatives of 15 general engineering firms in the Midlands and those of 19 other firms in the non-ferrous metal industry, will be in operation for the next six months. Results will then be reviewed and further policy determined.

Among the firms which will assist in introducing this "current scheme" are John and E. Sturge, Limited; Aldis Bros., Limited; Evertaut, Limited; Archibald Kenrick Sons, Limited; Phosphor Bronze Company, Limited; Hymatic Engineering Company, Limited; Siviter Smith & Company, Limited; Joseph Lucas, Limited; Firmin & Sons, Limited; Arthur Scrivener, Limited; Lodge Cottrell, Limited; Ash & Lacy, Limited; and Midland Electric Manufacturing Company, Limited. Three technical representatives from each firm will each month either visit another's premises or receive a visiting group. Each visit will last about half a day. At the end of the six months' trial period each team will have visited four other factories. Emphasis will be laid on methods of management and organization.

Another aspect of the Birmingham Productivity Association's work is the granting of scholarships in work study which will enable selected candidates to take 14-day full-time courses at the Birmingham Institution of Production Engineering under the direction of Professor T. U. Matthew, who is a member of the Association committee. A nominee of the British Non-Ferrous Metals Federation will begin his course under the new scheme on March 1.

COLT VENTILATION, LIMITED, of Surbiton, Surrey, are exhibiting nine of their constant-flow ventilators in the Davis house at the "Ideal Home" Exhibition, Olympia.

British Blast Furnaces in the December Quarter, 1953—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the fourth quarter, 1953.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	1	—	1	1	2
Shelton Iron, Steel & Coal	—	3	—	—	3	3	3
Stewarts and Lloyds: Bilston	—	3	—	—	3	3	3
TOTAL	—	6	3	—	9	9	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	13	64	25	5	107	106.5	138

Weekly Average Number of Furnaces in Blast during the December Quarter, 1953, and the Previous Four Quarters

District.	1952.	1953.			
	Dec.	March.	June.	Sept.	Dec.
Derby, Leics., Notts., Northants, and Essex	24.8	27.0	26.8	26.5	26.9
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	4.5	5.4	6	6	5·9
Lincolnshire	13.4	13	13	12.6	12
North-East Coast	25.2	24.8	24	24	24.7
Scotland	9	9	8.5	9	9
Staffs., Shrops., Worcs., and Warwicks.	8	8.1	7.8	8.9	9
S. Wales and Monmouth	8.8	9	8.4	7.6	9
Sheffield	2	2	2	2	2
North-West Coast	8	7.15	6.6	8	8
TOTAL	103.7	105.45	103.1	104.6	106.5

The following companies have furnaces in course of construction or rebuilding:—Darwen & Mostyn Iron; R. Thomas & Baldwins (Ebbw Vale); John Summers; Appleby-Frodingham Steel Co. (2); Stewarts and Lloyds (Bilston); Lysaght's Scunthorpe Works.

Board Changes

WHARTON CRANE & HOIST COMPANY, LIMITED—Mr. R. E. Harvey has joined the board.

BIRFIELD INDUSTRIES, LIMITED—Mr. W. R. Black has been appointed an additional director.

BRITISH POLAR ENGINES, LIMITED, GLASGOW—Sir Ian F. C. Bolton, Bt., has joined the board.

RAILWAY & GENERAL ENGINEERING COMPANY, LIMITED—Mr. Ernest Leslie Argyle has joined the board.

C. A. PARSONS & COMPANY, LIMITED—Mr. E. N. Robinson, deputy chairman of A. Reyrolle & Company, Limited, has been appointed a director.

HIRAM WILD, LIMITED—Miss Vera Fenwick has been appointed a director and assistant managing director of the company, and of Hiram Wild (Holdings) Limited.

Minibition, 1954.—The Purchasing Officers' Association is holding its fifth "Minibition" at the Royal Hall, Harrogate, from September 30 to October 2, in conjunction with its 1954 National Conference. The members of the Association, numbering 3,500, all hold responsible purchasing appointments in industrial or public undertakings and the "Minibition" is planned as an educational feature of the conference to give manufacturers an opportunity of bringing to members' notice the latest information regarding new products and developments in quality and design. Exhibits are displayed on small stands of standard size and pattern.

Inspection and Safety Bill

A private-members measure—known as the "Safety in Employment (Inspection & Safety Organization) Bill"*—is to have its second reading in Parliament on February 26. It is sponsored by 12 labour M.P.'s. The purpose of the Bill is to introduce accident-prevention organization in industry, based upon co-operation between employers, employees, and official inspectors. It is scheduled to come into operation on January 1, 1955, if approved.

Clause 1 places an obligation on employers and employees to set up a safety and health organization in all places of employment where not fewer than five persons are employed.

Clause 2 provides for the election of delegates representing the employees and specifies the rights and duties of the delegates. The delegates shall make a systematic inspection of all work places at least once a month and shall make a written report of the inspection together with any recommendations to the employer. The report shall be copied and displayed in a prominent place. The delegates shall report to any appropriate official inspector any matter prejudicial to the safety and health of the employees which has been reported to the employer without any action being taken within a reasonable time. The delegates may inspect any records kept by the employer under statutory provisions affecting the health and safety of employees, and shall receive copies of all communications relative to matters of the safety and health of employees sent to the employers by the appropriate official inspector. The clause also provides that the obligations of the employer and the official inspector with regard to the safety shall be specified by regulations and states certain obligations which must be included in the regulations.

Clause 3 requires safety committees to be set up where more than fifty persons are employed. This clause sets out the constitution and duties of the safety committees and contains an important paragraph which permits "any appropriate official inspector . . . to attend such meetings of any safety committee as he may think fit."

Clause 4 allows the Minister of Labour to establish a national occupational, safety and health committee representative of both sides of industry, Government departments, and national voluntary bodies interested in safety and health.

* Copies (Bill No. 18) may be obtained, price 6d., from H.M. Stationery Office.

Glasgow Engineering Classes

A suggestion by the director of the Royal Technical College, Glasgow, that day and evening courses in mechanical engineering subjects of higher national certificate standard might be transferred to Glasgow Corporation was considered on Friday by the City's Further Education Committee. It was stated that there was a desire in the college to concentrate on full-time study at the graduate and post-graduate stages, and on research, and gradually to relinquish a large proportion of the part-time courses. It was felt that the Corporation's further education department—already providing courses in mechanical engineering up to ordinary national certificate standard—might be willing to extend them to the higher standard.

Adoption of the proposal would entail the transfer from the college of 100 day students and 150 evening students. The committee agreed to the proposal in principle, but further consideration was deferred pending the submission of a report on how accommodation for the transferred students might be made available.

Large Overseas Orders for Britain

An order worth over $3,000,000 has been received by British Insulated Callender's Cables, Limited, from the British Columbia Electric Company for the supply and installation of some 77 miles of 138,000-volt gas-pressure type cable. The cable, in continuous lengths of approximately 17 miles each, will be laid across the Georgia Strait, off the British Columbia coast, for the transmission of power from the Canadian mainland to Vancouver Island, to provide an adequate supply for future development. The scheme is due to be in operation in 1956, and will transmit electricity under water at a higher voltage and at a higher carrying capacity than any other similar installation in the world.

Mr. C. Desmond MacQuaide, director of R. A. Lister, Limited, Dursley, Gloucestershire, said in Moscow on February 11 that he had signed a provisional contract for the supply of 90 Diesel generating sets of 410 kilowatt capacity for Russian power stations. The value of the contract is more than £1 million.

Mr. Harry L. Dowsett, chairman of Brooke Marine, Limited, Lowestoft, has signed a contract to build 20 trawlers for the Soviet Government after negotiations with the Ministry of External Trade in Moscow which lasted for five weeks. The cost of the vessels is more than £6,000,000 sterling. They will have Diesel propelling machinery, giving them a range of 7,000 miles. They will carry a crew of 44, and their loaded displacement will be 1,200 tons.

An initial order of $6,500,000 placed by the Hazeltine Electronics Corporation, New York, is to be shared by the British Thomson-Houston Company, Limited, Ferranti, Limited, and the General Electric Company, Limited. Additional orders worth many millions of dollars are expected to be placed shortly. The British firms will manufacture electronic equipment and associated test gear under the contract. It is estimated that the initial order will take two and a half years to complete.

Electrical Engineers' Exhibition

At the forthcoming Electrical Engineers' Exhibition organized by The Association of Supervising Electrical Engineers and to be held at Earls Court, London, from March 16 to 20, the Brush Electrical Engineering Company, Limited, Loughborough, will be exhibiting on Stand 100, switchgear, fuse gear and electrical rotating machinery, built at the firm's Loughborough and Cardiff works.

On Stand No. 35, Simplex Electric Company, Limited, will include new "Regent" switchgear panels, flameproof switchgear panels, and unique items such as Britain's only fully-certified, flameproof handlamp and switch socket, a new range of "Ironclad" switches of compact design, and the Lundberg "Miniac" range of a.c. switches and switch sockets.

At the same exhibition, Henry Wiggin and Company, Limited (Stand No. 76) will make available technical publications giving data on the wide range of high-nickel alloys which are supplied in wrought form to the electrical industry. Foremost amongst these are the "Brightray" alloys—a series of resistance materials for most types of electrical resistance heating up to 1,150 deg. C. This firm has recently introduced two new grades of commercially "pure" nickel known as HPA and HPB nickel. The former is recommended for components of valves operating at high temperatures, while HPB nickel is intended primarily as a material for cathodes where the sublimation of magnesium cannot be tolerated.

News in Brief

THE FEBRUARY ISSUE of the F.B.I. Review contains an illustrated article by Dr. J. G. Pearce, O.B.E., on the achievements of the British Cast Iron Research Association.

AN INDUSTRIAL RESEARCH LABORATORY of 10,000 sq. ft. area for the welding industry is to be opened on March 31 at the works of Quasi-Arc, Limited, Moxley, Bilston.

BETWEEN 30 AND 40 FOUNDRY FIRMS are listed as having taken space at the Scottish Industries Exhibition, which is to be held at Kelvin Hall, Glasgow, from September 2 to 18.

IMPORTS into the Tees last December amounted to 381,024 tons, an increase of 86,881 tons on December, 1952. The increase was due chiefly to higher imports of iron ore, scrap, and coal.

OXHYCARBON COMPANY, LIMITED, 6, Hainthorpe Road, West Norwood, London, S.E.27, have recently developed and placed on the market a new "Quicky" portable flame-cutting machine to be known as Type B.

MEARS & STAINBANK, LIMITED, have just re-cast a theatre call-bell, dated 1795, originally made at their own foundry in Whitechapel Road, London. The bell which was discovered in an antique shop has been presented by the finder to Sadler's Wells Opera and Ballet Company.

TEMPLE INSTRUMENTS, LIMITED, Wolverhampton, have produced a range of steel core-box vents. An advantage of steel vents over those of brass is said to be the virtual elimination of adhesion by the core to the vent, making for quicker production and less need for re-touching.

WITH A VIEW to improving Lanarkshire's economic position for the benefit of all engaged in industrial output, a Productivity Committee has been formed in Motherwell, with Dr. T. Scott Glover, managing director of R. Y. Pickering & Company Limited, rolling-stock builders, Wishaw, as chairman.

LONDON METAL WAREHOUSES, LIMITED, have opened a new warehouse at 269, Moseley Street, Birmingham. The existing offices and showroom premises at 16, Prospect Row, Birmingham, are being retained, and it is hoped that the additional accommodation now available will result in improved service to the area.

TWO SHIPMENTS of pig-iron from Russia arrived on the Clyde last week-end. They are part of a 100,000-ton contract arranged recently between Britain and Russia. The two Russian ships, the Gribojedov and the Sukhumi, are the first to come to the Clyde for about three years. The pig-iron is intended for Colvilles' steel works.

"BICALOY" ELECTRODE TIPS continue to be manufactured by British Insulated Callender's Cables Limited. Although the manufacture of their resistance welding and heating machines was recently taken over by Metropolitan-Vickers Electrical Company Limited, the arrangement does not affect the electrode tips.

A PROPOSAL from the South-East Scotland Electricity Board to introduce a standard form of industrial tariff on April 1 this year came before the South-East Scotland Electricity Consultative Council on February 2, and it was decided to postpone any decision until after the District Committees had had opportunity to discuss the proposals.

THE LEEDS AND BRADFORD JOINT AERODROME COMMITTEE, meeting in Leeds last week, decided to recommend to the Leeds and Bradford Corporation that 3.79 acres of land adjoining Yeadon Aerodrome should be sold to Hepworth & Grandage (Yeadon), Limited, founders, for the purpose of extending their premises. The land is at present leased to the company.

THAT SUBSTANTIAL SAVINGS in electricity costs (amounting to as much as ½d. per unit) can be achieved by industrial consumers by installing equipment for power-factor correction is mentioned in a statement issued by the Birmingham and District Local Committee of the Electricity Consultative Council.

MR. G. HENDERSON, London manager and chief branch office manager (home), of Bruce Peebles & Company, Limited, Edinburgh, has been appointed general sales manager. He will be responsible for the co-ordination of all aspects of the company's sales organization at home and oversea. Mr. N. L. Young, his assistant, has been appointed London manager.

MORE THAN 200 attended the annual dinner of Rolls Royce, Ilkeston branch, which was held at the Blue Ball, Risley. Among those present were Mr. J. D. Pearson, director and chief executive, aero division, Mr. S. F. Kelly, general manager, aero division, Mr. C. Birch, assistant manager, Derby, and Mr. K. W. Page, manager, Ilkeston Power Plant Division.

A SUBSTANTIAL CONSTRUCTION contract from the Sudanese Government has been secured in the face of considerable competition by the Motherwell firm of Hurst, Nelson & Company, Limited. The contract is for 30 of the type of tank wagons which the firm has specialized in producing within recent years. Work on the order is expected to begin early next year.

MR. E. FLETCHER, secretary of the production department of the Trades Union Congress, Birmingham, in an address to the West Midlands Group of the British Association for Commercial and Industrial Education, appealed to employers' organizations to take trade unions into their confidence and consult them when preparing education schemes within an industry.

AMONG the appointments announced by the International Harvester Company of Great Britain, Limited, in the management of the sales side of the business is that of MR. DAVID C. HANEY in the newly created position of director of sales. MR. D. J. MCINTOSH, the new manager of sales, commenced service with I.H. in Britain in 1929. The new assistant manager of sales is MR. R. R. KING.

THE DIRECTORS of George Cohen Sons & Company, Limited, have resolved that the half-yearly dividend due on March 31 on the £1,500,000 4½ per cent. cumulative preference stock be paid at the rate of 4½ per cent. per annum less tax, and that an interim dividend of 3½ per cent actual, less tax, be paid on the £1,500,000 ordinary stock of the company on March 31st, in respect of the company's financial year ending on that date.

TWO SOUTH WALES tinplate works, the Morriston and Midland Works, Morriston, Swansea, and the Gwalia Works, Briton Ferry, of the Briton Ferry Steel Company, Limited, are to be closed permanently. The works have been open on a care and maintenance basis only since they ceased production last May. They are being closed because the company finds it impossible to restart production owing to the general shortage of skilled tinplate workers.

MR. WILLIAM DAVID PUGH, who is a director of the English Steel Corporation, Limited, in charge of steelmaking, and labour and personnel, has been elected a director of High Speed Steel Alloys, Limited,

News in Brief

Widnes. He is also managing director of Darlington Forge, Limited, and a director of Firth Vickers Stainless Steels, Limited, and of Taylor Bros. & Company, Limited, tyre-steel and axle makers, of Trafford Park, Manchester.

ACCORDING TO Mr. David Brown, head of the David Brown group of companies, who has just returned from the Argentine, that country wants 100,000 tractors immediately and afterwards there will be orders for about 20,000 a year. The Argentine Government has announced that Mr. Brown will manufacture tractors there. Meanwhile, plans have been laid to import partly complete tractors, so that some parts can be manufactured in the Argentine.

OF 500 TYNESIDE FIRMS APPROACHED, only 50 had announced their willingness to take part in a scheme for an interchange of factory visits to help productivity, according to Mr. R. W. Mann, chairman of Tyneside Productivity Committee. He said that 70 per cent. of the firms had not replied, 10 per cent. were not interested, 5 per cent. were in the middle of reconstruction schemes, and 5 per cent. contended that their works were not suitable for the scheme.

AN INCREASE in drivers' work output by an average of 25 per cent. within the past two years is reported by the Metals Division of I.C.I., Witton, as a result of applying incentive schemes. The scheme also applied to maintenance men, who have reduced the average time of a job from four and a half hours to a little over two hours. The scheme is based on work measurement. During the first three months the scheme was in operation the drivers averaged a 17-70 unit hour; now the top group regularly attains an 80-84 unit hour.

VERY SOON, circular loom No. 1000 will come off the production line at Blackness Foundry, Dundee. It was in 1947 that Saint Freres granted the rights of manufacture to Fairbairn Lawson Combe Barbour, Limited, of which the well-known Dundee firm of Urquhart Lindsay & Robertson Orchar, Limited, is a subsidiary. Two years later, in August, 1949, the first Dundee-made circular loom of this type received its final adjustment and was labelled for the Belgian Congo. They rolled out quickly after that, and the despatch department became like a world clearing house.

A BATTLE between Government departments over money for the building of the mechanical engineering research station at East Kilbride has ended with a decision to set a ceiling of £2,000,000 as the cost of the project. This will mean that many of the laboratories that were to have been included in the station will now have to be cut out. At one time it was thought that the cost of the research station might go as high as £5,000,000. The Treasury, concerned at the mounting cost of the scheme, stepped in and ordered a review of the whole project.

THE INTEREST IN INDUSTRY of the Queen and the Duke of Edinburgh was shown on February 9, when the Commonwealth tour took them to Newcastle, New South Wales, to visit the iron and steel works of the Broken Hill Proprietary Company, Limited. The roval visitors watched with interest a 10-ton charge of coke pushed from a coke oven and the tapping of molten metal from one of the blast furnaces. The visit necessarily had to be rapid, but in a tour of some 40 minutes they saw five different departments, and met the superintendent and two workmen from each.

THE twenty-fifth meeting of the Iron and Steel Engineers' Group of the Iron and Steel Institute will be held at 4, Grosvenor Gardens, London, S.W.1, on March 18. The detailed programme includes presentation and discussion of "Treatment of Water for the Iron and Steel Industry," by A. J. Lamb and A. H. Waddington, and, in the afternoon, "Modern Industrial Boiler Plant," by W. P. C. Ungoed. Members wishing to attend the meeting are asked to complete and return a reply form by March 12. They may bring guests.

A SPECIAL EXHIBITION, "Ultra-violet Light in Industry and Commerce," organized by Hanovia, Limited, Slough, is being held in conjunction with the Midlands Electricity Board at their showrooms at 247, Chester Street, Aston, Birmingham, 6, from February 15 to 26 (Saturdays and Sundays excepted). It is open from 10 a.m. to 4 p.m. daily. Among the many exhibits featured is a continuous demonstration of the non-destructive crack-detection fluorescence unit, a water sterilizer, air sanitizers, many types of ultra-violet analytical and inspection lamps, chromatography and fluorescence microscopy.

GIVEN a product of quality that can meet and beat competition, and given the necessary effort, a British producer can enter the American market and stay there, Mr. Lincoln Gordon, Minister for Economic Affairs at the American Embassy, declared in an address to the Coventry Chamber of Commerce. This was proved, he said, by the experience of British car and cycle makers. Before the war the U.S. imported only some 350 British cars annually, but in 1952 they reached a record of over 30,000. Cycle sales to the U.S. had expanded one-hundredfold, from 4,000 a year pre-war to 400,000 in 1953.

USUAL SEASONAL CHANGES resulted in an increase in the number of persons unemployed at January 11. The increase over December 7, 1953, was 51,000, bringing the total to 372,900, but this was 80,000 fewer than a year ago. January's total represents 1.8 per cent. of the estimated working population, which in December showed a seasonal decrease of 100,000 to 23,470,000, although the overall figure in 1953 increased by about 150,000. There was a decrease during the month of 1,000 people in the engineering, metal goods, and precision instrument industries. In metal manufacture the figure remained steady, and there was a rise of 4,000 in those employed in vehicle manufacture.

MR. H. S. BROOM, chairman of Broom & Wade, Limited, manufacturers of air compressors and pneumatic tools, High Wycombe (Bucks), attributes the excellent trading results in the year to September 30 last to the heavy backlog of orders. Turnover increased by some 11 per cent., and the group's net untaxed profit of £516,846 was a record, exceeding the previous year's figure by £84,687. Mr. Broom says that the rate of incoming orders remained below the peak reached in 1952. At the end of that year, delivery dates quoted on the heavier products were up to approximately two years. Incoming orders—considerably improved during the last few months—together with those in hand will carry the group on for a further 12 months. The Australian company made smaller profits as a result of import restrictions. Mr. H. S. "Dick" Broom, joint managing director of the parent company, is going to Australia shortly to review with the company there its needs for the future and to consider how best it can compete with the increasing competition both from outside and from local production.

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FS/14

Personal

MR. E. S. WADDINGTON, of the industrial products department of Philips Electrical, Limited, has been appointed a trustee of the Society of Engineers.

MR. JOSIAH ECCLES, deputy chairman (operations) of the British Electricity Authority, has been appointed a member of the Scientific Advisory Council in succession to Sir John Hacking.

MR. J. C. WOOD, a director of John Fowler & Company, Limited, tractor and locomotive builders, of Hunslet, Leeds, has been presented with a silver coffee set on his retirement after 52 years' association with the company.

MR. & MRS. FRED PICKERSGILL, of Brighouse, who are both 72, have celebrated their golden wedding. Mr. Pickersgill was employed for 42 years at J. Blakeborough & Sons, Limited, founders and valve makers, of Brighouse.

MR. THOMAS ALOYSIUS MCKENNA, chairman and managing director of Staveley Coal & Iron Company, Limited, received an honorary degree of Doctor of Laws of Sheffield University on February 5, after the formal opening of the University's new chemistry building.

MR. GEORGE M. MENZIES, managing director of the North British Foundry Limited, Bathgate, has been appointed a director of the Scottish Motor Traction Company, Limited, Edinburgh. He is a member of the Grand Council of the Federation of British Industries.

MR. FRANK J. DOST, president, Sterling Foundry Company, and MR. BRUCE L. SIMPSON, president, National Engineering Company, Chicago, have been nominated as president and vice-president respectively of the American Foundrymen's Society. They will assume office at the annual business meeting to be held in Cleveland on May 12.

MR. DOUGLAS DIGBY RAWLEY has been appointed to the Board of Hadfields, Limited, as sales director. Mr. Hawley joined the staff of Hadfields in the estimating department in 1919, later taking over the special-steels section of the sales department. He became sales manager in 1946 and was appointed a local director in 1948. Mr. Hawley is a member of the executive council of the British Steel Founders' Association.

MR. G. E. H. HALL last week took up his appointment as general manager of Sheepbridge Stokes Limited and British Van der Horst Limited, both member firms of the Sheepbridge Group, producing centrifugal castings and engine cylinder liners. Mr. Hall leaves his former post of works manager with Light Production Limited, Slough, another Sheepbridge company. Before that, he was works manager with Wellworthy Limited.

MR. G. B. DAVIES and MR. W. L. TURNER have been appointed joint assistant managing directors of Qualcast (Wolverhampton), Limited, and of Qualcast (Swan Gardens), Limited, the two Wolverhampton subsidiaries of Qualcast, Limited, of Derby. Mr. Davies, who first joined the company at the age of 14, and, after a short break, has been with them for 20 years, has been works manager and a director of Qualcast (Wolverhampton), Limited, and Mr. Turner has been sales manager and a director of the same company.

MR. S. C. BOND, who succeeds Colonel Arthur Jerrett as chairman of the National Council of the Traders' Road Transport Association, is transport and shipping manager of the Stanton Ironworks Company Limited, and chairman of the Association's East Midland division. Col. Jerrett, who has resigned, is a director of Guy Motors, Limited, Wolverhampton.

MR. ERIC FREER has been appointed foundries general manager of the Staveley Iron & Chemical Company, Limited. He will succeed Mr. N. R. Rees, who has retired. He has been connected with the firm for 38 years, and began work in the foundry department drawing offices of the Staveley Company. In 1943 has was appointed foundries production manager, and last year he became deputy to Mr. Rees. Mr. Freer is a member of the Institute of Mechanical Engineers, and a member of the Institute of British Foundrymen.

MR. W. G. A. INGLIS has been appointed senior lecturer in the Mechanical Engineering Department of the Heriot-Watt College, Edinburgh, as from April 1. He is an old student of the College, where he took his associateship in Mech. Eng. with distinction in 1934 and, at the same time, gaining the Higher National Diploma on Mech.Eng. with seven distinctions. Since leaving the College, he has had considerable experience in industry and has recently been a lecturer in Mech. Eng. at Derby Technical College. MR. R. A. HUGHSON, a second year mining student at the college, has been awarded a travelling scholarship by the Institution of Mining & Metallurgy, to enable him to obtain practical experience in British Columbia during the summer vacation.

Obituary

MR. L. H. BARTLETT, a director of the Central Provinces Manganese Ore Company, Limited, died recently.

MR. ALEXANDER THOMPSON WILSON, of James Wilson & Sons, consulting engineers and machinery merchants, of Glasgow, died early this month.

MR. JAMES CAMERON, who was formerly assistant manager of the shiprepairing section of Barclay, Curle & Company, Limited, Glasgow, died on February 4.

THE DEATH has taken place at his Kidderminster home of MR. VINCENT EDWIN YOUNG, at the age of 71. Mr. Young was a director of British Castings, Limited, Old Hill, and of Burton Delingpole & Company.

THE DEATH has occurred of MR. ALBERT CAMPBELL, who was one of the founders of the National Physical Laboratory in 1901 and who remained on the staff until his retirement in 1918. He was 91.

MR. LONSDALE ALLEN, who was formerly chairman of Gill & Russell, Limited, tube and fitting manufacturers, of Walsall (Staffs), has died at the age of 87. He joined the company in 1909 and was chairman from 1917 until March last year.

MR. HENRY JAMES CREESE, chairman of H. J. Creese & Sons, Limited, ironfounders, of Leicester, died on February 9 at the age of 57. He had been a member of the Institute of British Foundrymen since 1942, and served for many years on the committee of Leicester and District Ironfounders' Employers' Association.

THE DEATH has occurred at his Church Stretton home of MR. JAMES HOWARD WILSON, chairman of Evered and Company Limited, Smethwick. He was 77. In 1919, Mr. Wilson bought control of the firm and was its first managing director. He became chairman in 1942. A West Bromwich man by birth, he was a member of many associations connected with the non-ferrous metal industry. He was for many years on the Smethwick Bench and was a former chairman of the Smethwick Unionist Association.

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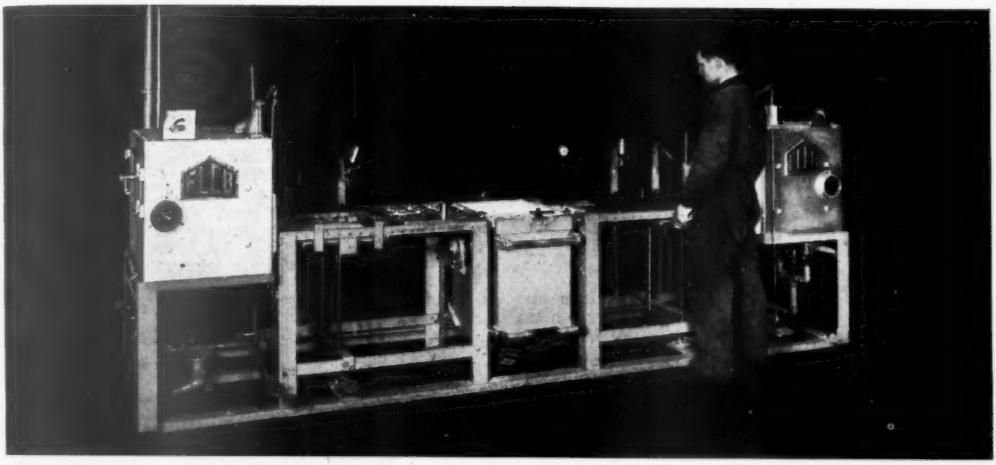

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Raw Material Markets

Iron and Steel

Consignments of Russian pig-iron are now arriving regularly in South Wales, but the price is understood to be at least £2 per ton above the cost of home-produced basic iron, and although 107 British blast furnaces are now in operation, it is evident that additional capacity is required as soon as it can be made available. The severe weather and consequent irregularities in delivery of raw materials have not impeded furnace operations, as works have big reserve stocks in hand. But consumer demand is very heavy, not only for basic iron for the open-hearth steel plants but also for the heavy engineering foundries, whose requirements embrace hematite and low- and medium-phosphorus irons. In fact, the only grade obtainable in ample quantities is No. 3 foundry iron, which is the principal raw material of the light-castings industry.

Although the importation of marginal supplies of steel semis from the Continent still continues, the tonnages involved are steadily shrinking. With increased ingot capacity and new billet mills in operation, British steelmakers are able to provide most of the semi-finished steel required in the home market. The limited demand for billets is, of course, a reflection of the depressed conditions now prevailing in the bar re-rolling industry, but, by way of contrast, there has developed a very much livelier call for sheets bars and slabs.

The decision of the British Iron and Steel Federation to cut the export price of steel plates by £5 per ton has been roundly criticized, because supplies to home consumers have not yet fully overtaken the demand. But the position is changing rapidly. A record output of 2,400,000 tons was achieved last year, and as capacity is still increasing, the time has come to remove some of the restraints upon the export trade and to bring British prices into line with Continental quotations. Furthermore, it is pointed out that the reduced export price of £38 per ton for mild-steel plates still represents a substantial premium on the quotation of £30 6s. 6d. quoted for deliveries to British users.

Productivity in many branches of industry has recently been stimulated by the improvement in deliveries of finished steel products. Even the supply of plates is now almost in balance with requirements and the speedier fulfilment of orders for other classes of steel products is a great help to consumers. A steady flow of specifications is reaching the heavy rolling mills, but the brightest feature of the market is the sheet trade. Home requirements are substantial and big export bookings ensure capacity working of the sheet mills up to the end of June.

Non-ferrous Metals

Thanks to a last-minute rally by cash copper, the market showed up very well last week with a net gain of £4 10s. in that position, while three months put on £1 15s. The backwardation moved out to £17 10s. on the basis of the midday prices, but in the afternoon the forward position improved by 15s. without any change in cash, and therefore there was some narrowing of the backwardation, which was the widest seen for some months. At the end of the week cash copper was quoted at £232 10s., which is equal to approximately 29 cents, compared with 29¼ cents asked by the Custom smelters in the United States and 30 cents at which the producers' price is maintained. Considerable fluctuations were seen in zinc and the backwardation widened to 35s., owing to the continued shortage of prompt metal. On balance, February declined by 15s. and May by 20s. Tin moved within small limits and finally closed without any change. Once again, a backwardation of £1 returned to lead, which lost 5s. for February and 20s. for May.

The long-awaited revision in the lead contract has now been announced, and the new arrangement, under which dealing is for each half of the month, will be effective from June 1 next. It is hoped that the change may attract buyers.

Figures in respect of December have been published by the British Bureau of Non-ferrous Metal Statistics. Our consumption of virgin and scrap lead was 26,582 tons, against 27,358 tons in November. Stocks of virgin lead at December 31 were 26,887 tons, compared with 29,174 tons at the end of November. In zinc the trend was in the opposite direction, for there was an increase of 5,190 tons to 27,652 tons, while consumption, all grades, was some 300 tons down, at 26,689 tons. Copper made quite a good showing, with consumption at 42,233 tons, against 42,217 tons in November. For the year 1953 total usage was 446,003 tons, compared with 571,839 tons in 1952. Stocks of refined copper on hand at the end of December were 55,344 tons, an increase of about 5,000 tons over November 30. Unfortunately, the tonnage in L.M.E. approved warehouses continued to fall and stood at 2,052 tons, compared with 3,253 tons at the end of November. Today these stocks are probably below 1,000 tons.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* February 11, £228 10s. to £229; February 12, £232 to £232 10s.; February 15, £232 10s. to £235; February 16, £234 to £235; February 17, £234 10s. to £235.

Three Months: February 11, £214 to £214 10s.; February 12, £214 15s. to £215; February 15, £215 15s. to £216; February 16, £216 to £216 10s.; February 17, £216 15s. to £217.

TIN, Standard—*Cash:* February 11, £655 to £656; February 12, £654 to £655; February 15, £660 to £665; February 16, £667 10s. to £672 10s.; February 17, £674 to £675.

Three Months: February 11, £635 to £636; February 12, £634 to £635; February 15, £636 to £637 10s.; February 16, £640 to £645; February 17, £643 to £644.

ZINC—*February:* February 11, £72 to £72 10s.; February 12, £72 to £72 5s.; February 15, £71 10s. to £71 15s.; February 16, £71 10s. to £71 15s.; February 17, £72 to £72 5s.

May: February 11, £70 10s. to £70 15s.; February 12, £70 10s. to £70 15s.; February 15, £70 to £70 5s.; February 16, £70 to £70 5s.; February 17, £70 10s. to £70 15s.

LEAD—*February:* February 11, £82 10s. to £82 15s.; February 12, £82 10s. to £83; February 15, £81 15s. to £82 5s.; February 16, £82 to £82 5s.; February 17, £82 5s. to £82 10s.

May: February 11, £81 15s. to £82; February 12, £81 15s. to £82; February 15, £81 5s. to £81 10s.; February 16, £81 to £81 10s.; February 17, £81 15s. to £82.

Notes from the Branches—Correction. The regrettable omission of a cross-column heading in last week's issue of the JOURNAL on page 157 made it appear that the "works visits" were part of the Newcastle-upon-Tyne branch activities. The interposing of a heading, "Bristol and West of England," would have put matters right.